CIAL SCIENCES

INDUSTRIAL MEDICINE

Industrial Health, Occupational Medicine and Traumatic Surgery

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GENERAL MOTORS MEDICAL CONFERENCE

Periodic Re-Examination of Employees
— Including the Management Group —

The Newer Topical Uses of Penicillin
— In the Treatment of Dermatologic Infections —

Trauma and Disease
— The Etiological Factors in Injury —

Plant Inspections
— By Plant Physician and Safety Director —

Wound Healing
— And Early Ambulation —

Medicine and Research
— Health and the Indefatigable "Why" —

Integration of Medical Services
— The Symphony of Expert Coordination —

Conference Presentations
— Authors' Abstracts of Thirty Papers —

Placing the Handicapped
— A Positive, Individual and Specific Approach —

A Modern Plant Medical Program
— The Rationale of Its Being —

Volume 15 Number 10

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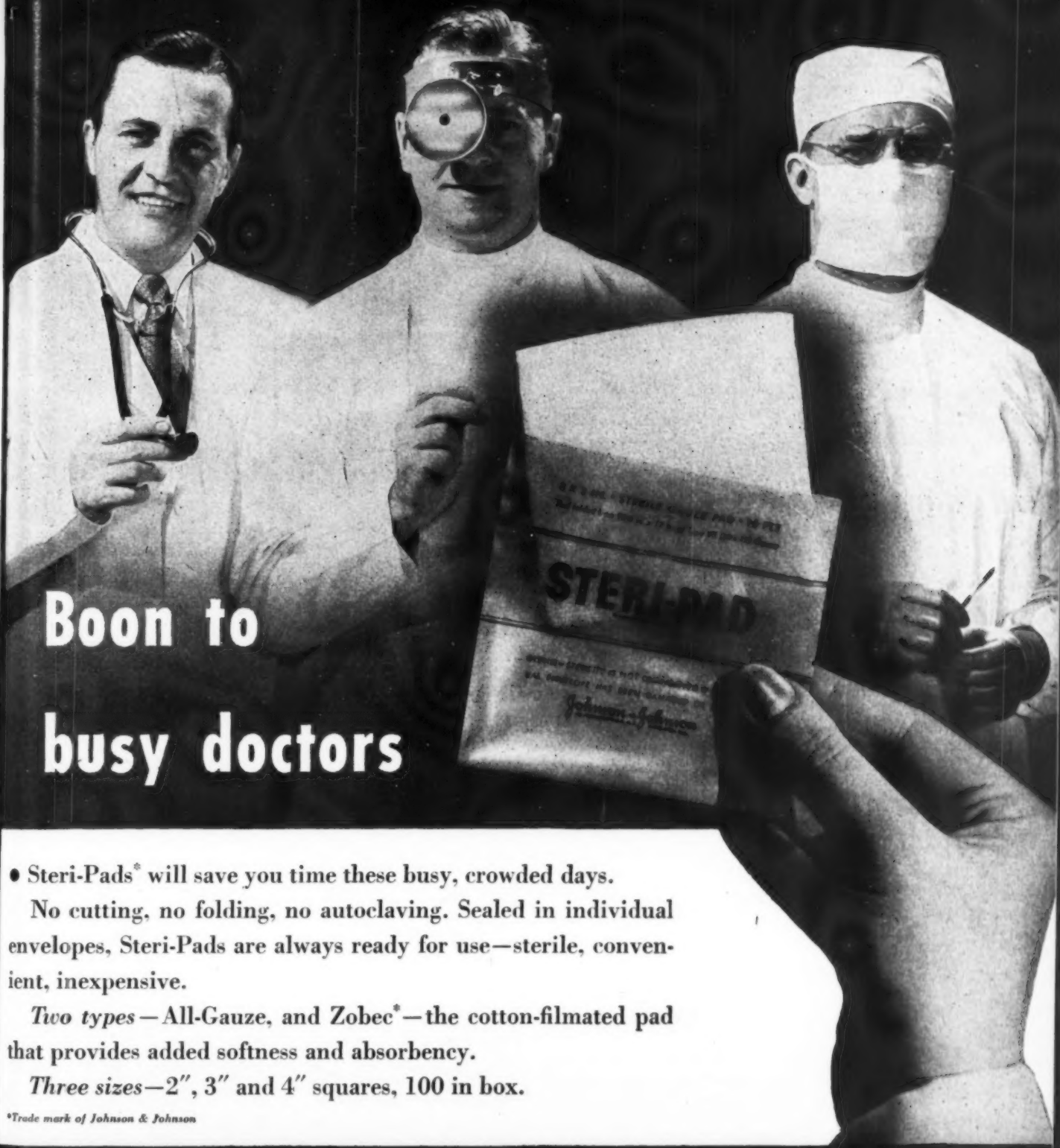

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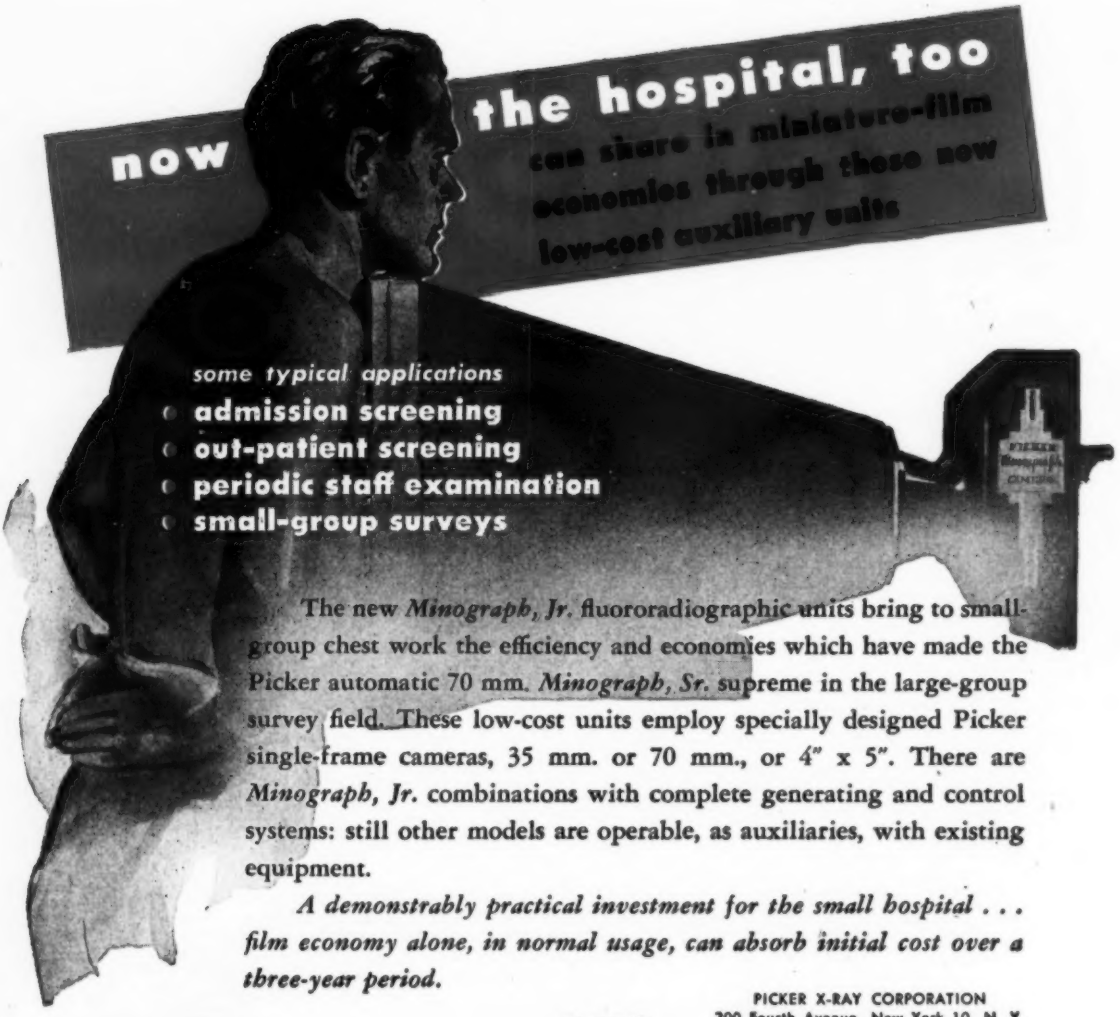

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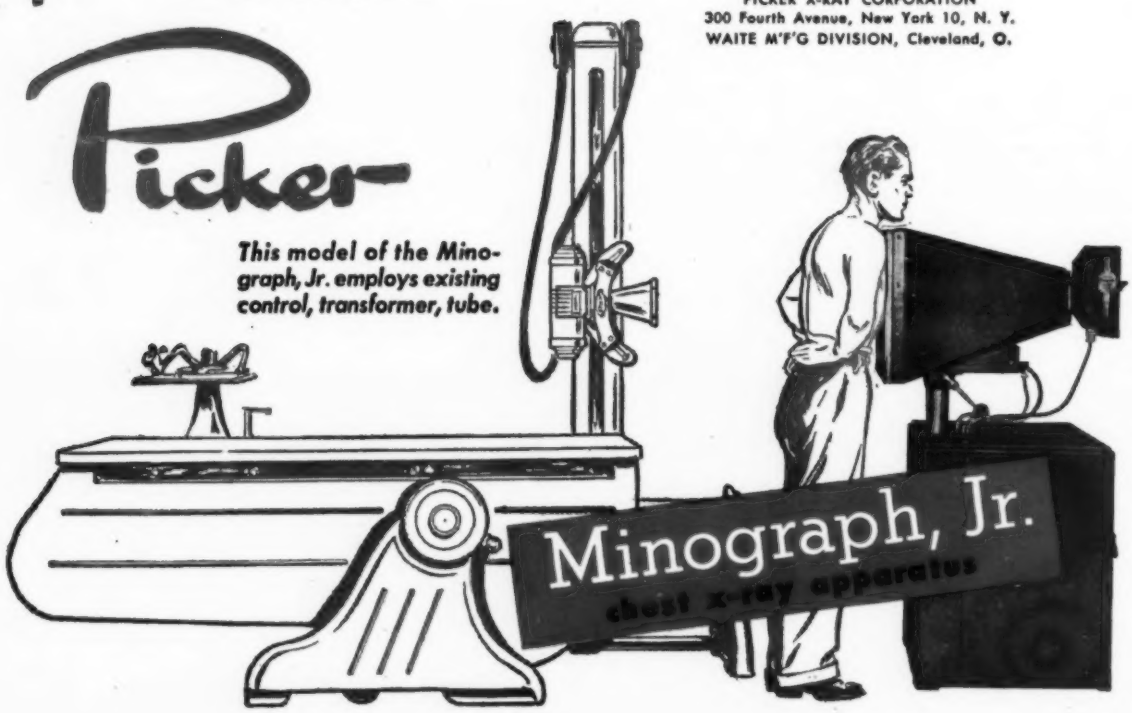

MEDICINE SURGERY

INDUSTRIAL HEALTH
OCCUPATIONAL DISEASES
TRAUMATIC, INDUSTRIAL

INDUSTRIAL HYGIENE
INDUSTRIAL MEDICINE
& RAILROAD SURGERY

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DR. REEVE BROWN'S paper on "Trauma and Disease" at the General Motors Medical Conference (see page 575) acknowledges its debt to the textbook, "Reaction to Injury," written by WILEY D. FORBUS, M.D., of the Department of Pathology, Duke University School of Medicine, published by The Williams & Wilkins Company, Baltimore. DR. BROWN refers to this text as "an ideal presentation," and, as he follows it closely throughout his own discourse, he desires us to make sure that the credit to DR. FORBUS is in no way limited by any failure to acknowledge it fully and completely within the "four corners" of his use of it. The full acknowledgment, therefore, is the purpose of this mention. . . . THE editorial, "Physician to the President" (page 604), highlights a subject which has very timely significance in these days of so many openings for industrial physicians and so many expectations of securing such physicians at inconsiderable salaries. As DR. O'CONNOR says (page 620), "management's choice of physician is the key to the effectiveness of a modern industrial medical program." It will be a poor and inadequate "key" that won't be permitted to unlock the door to the President's office. . . . THE item entitled "True Then—True Now" (page 10) was written 73 years ago, at the conclusion of a book-length protest against the then domination of governments by the so-called "industrial interests." It summarizes the situation in which the pendulum had swung to one extreme, but it might well have been written as of today when the pendulum has gone clear over to the other end of its sweep. The element of hope is that, since it did come back from its 19th century extreme, it will also come back from its 20th century divagation to the left. The advice is still good: "Don't sell America short!"

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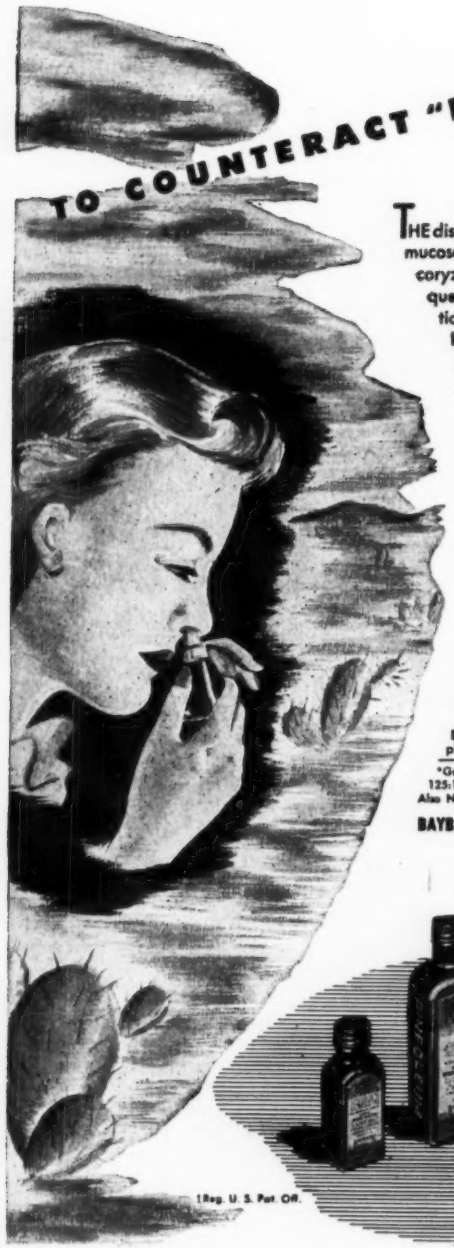

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*Griesman, B. L.: Arch. Otolaryngology 39:124, 1944: abst. J.A.M.A. 125:173, 1944: Yearbook of Eye, Ear, Nose & Throat, 1944, p. 309. Also Novak, F. J., Jr.: Arch. Otolaryngology 38:241, 1943.

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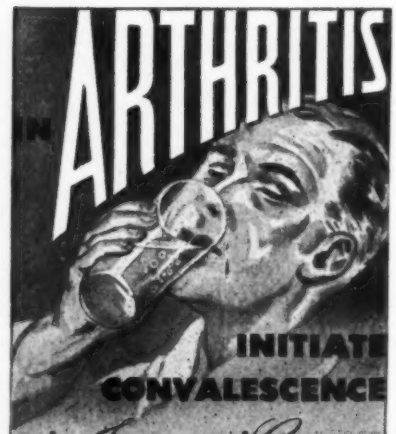

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PERSONAL

DR. HENRY H. KESSLER, 53 Lincoln Park, Newark, New Jersey, has been appointed to the Permanent International Committee on Industrial Medicine, which conducts research in 23 nations. The notification was received in a letter from Professor J. Carozzi, secretary general at Geneva, Switzerland. DR. KESSLER is a former Navy Medical Corps captain who saw service in the South Pacific.

J. M. BAENA-LAVALLE, M.D., has been appointed Director of Industrial Medicine and Hygiene Division of the Ministry of Labor of the Republic of Columbia. Dr. Baena-Lavalle is an active member of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS.

JOHN W. BROWN, M.D., has been appointed Industrial Hygiene Physician for the Pittsburgh area of the Bureau of Industrial Hygiene of the Pennsylvania Department of Health. DR. BROWN, a graduate of the University of Pittsburgh Medical School in 1943, served with the Army in Europe and was discharged from the service in April, 1946. He aided in the organization of the Ramagen Prisoner of War Camp and did work in preventive medicine and hygiene among the 178,000 German prisoners confined there. He has been awarded the Bronze Star, the Purple Heart with two oak leaf clusters, the Combat Medical Badge and the European Theatre Ribbon with four campaign stars.

DR. W. L. HOGUE, JR., has been appointed Medical Department Head for Firestone Tire & Rubber Company, Akron, Ohio, to succeed DR. DAN MOORE MCDONALD, who retired on September 1, after 40 years of medical service with the company. DR. HOGUE, a native of Montpelier, Ohio, was graduated from Northwestern University Medical School in 1919, and has had 17 years of service with the Firestone Medical Department. DR. MCDONALD'S career as a pioneer and leader in the field of industrial medicine will be given the consideration it so fully merits in a future issue of this Journal.

WANTED: Chemist, for a State Board of Health Industrial Hygiene Unit; salary range $260.00 to $310.00 per month. Must be graduate of a recognized college with a major in chemistry, and have three years' professional experience in anal-

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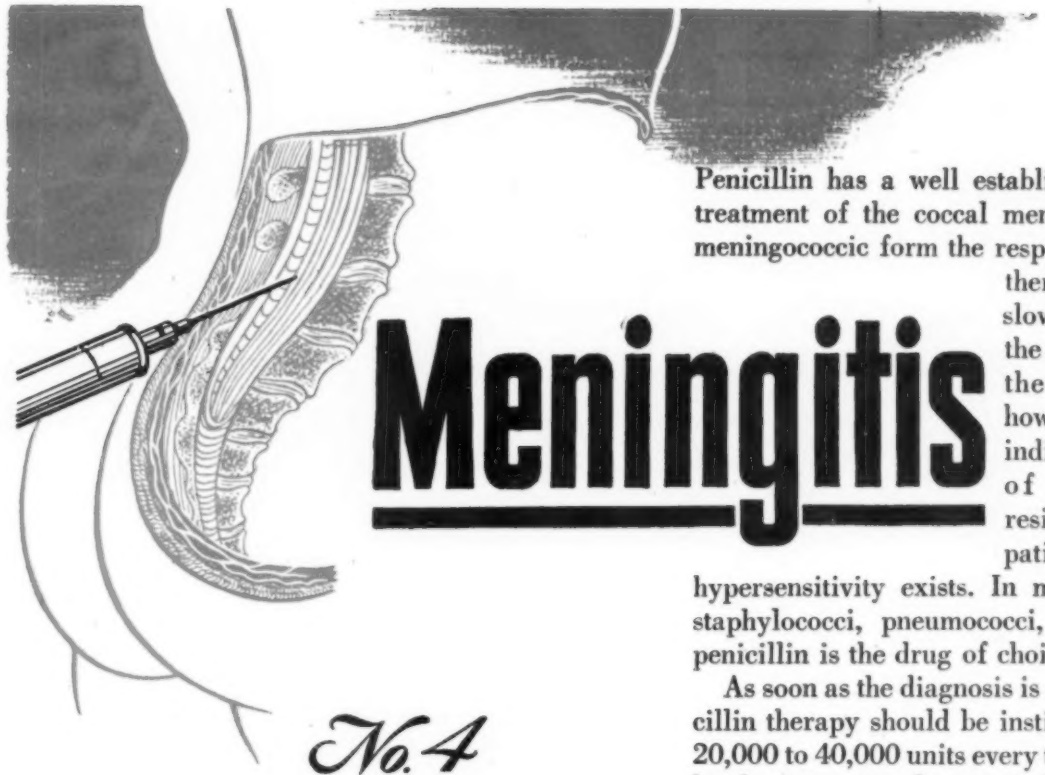

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As soon as the diagnosis is established, penicillin therapy should be instituted in doses of 20,000 to 40,000 units every two to three hours by the intramuscular route. Treatment should be thorough, and should be continued until all signs and symptoms of the infection have been absent for seven to ten days. Since penicillin administered systemically does not penetrate the subarachnoid space, intrathecal (intraspinal, intracisternal, intraventricular) administration is also required. Ten thousand units in 10 cc. of isotonic solution of sodium chloride should be injected (after withdrawal of an equal volume of fluid) once or twice daily until the spinal fluid is clear, and for four days thereafter.

When concurrent sulfonamides are indicated, they should be administered in a dosage sufficient to establish a blood level of 15 mg. per cent.

Surgical, supportive, and other measures should be employed when indicated.

SPINK, W. W., *and* **HALL, W. H.:** *Penicillin Therapy at the University of Minnesota Hospitals: 1942-1944, Ann. Int. Med. 22:510 (April) 1945.*

WHITE, W. L.; MURPHY, F. D.; LOCKWOOD, J. S., *and* **FLIPPIN, H. F.:** *Penicillin in the Treatment of Pneumococcal, Meningococcal, Streptococcal, and Staphylococcal Meningitis, Am. J. Med. Sc. 210:1 (July) 1945.*

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THE American Academy of Allergy will hold its annual convention at Hotel Pennsylvania, New York City, November 25-27 inclusive. All physicians interested in allergic problems are cordially invited to attend the sessions as guests of the Academy without payment of registration fee. The program has been arranged to cover a wide variety of conditions where allergic factors may be important. Papers will be presented dealing with the latest methods of diagnosis and treatment as well as the results of investigation and research. Advance copies of the program may be obtained by writing to the Chairman on Arrangements, DR. HORACE S. BALDWIN, 136 East 64th Street, New York City, prior to November 10.

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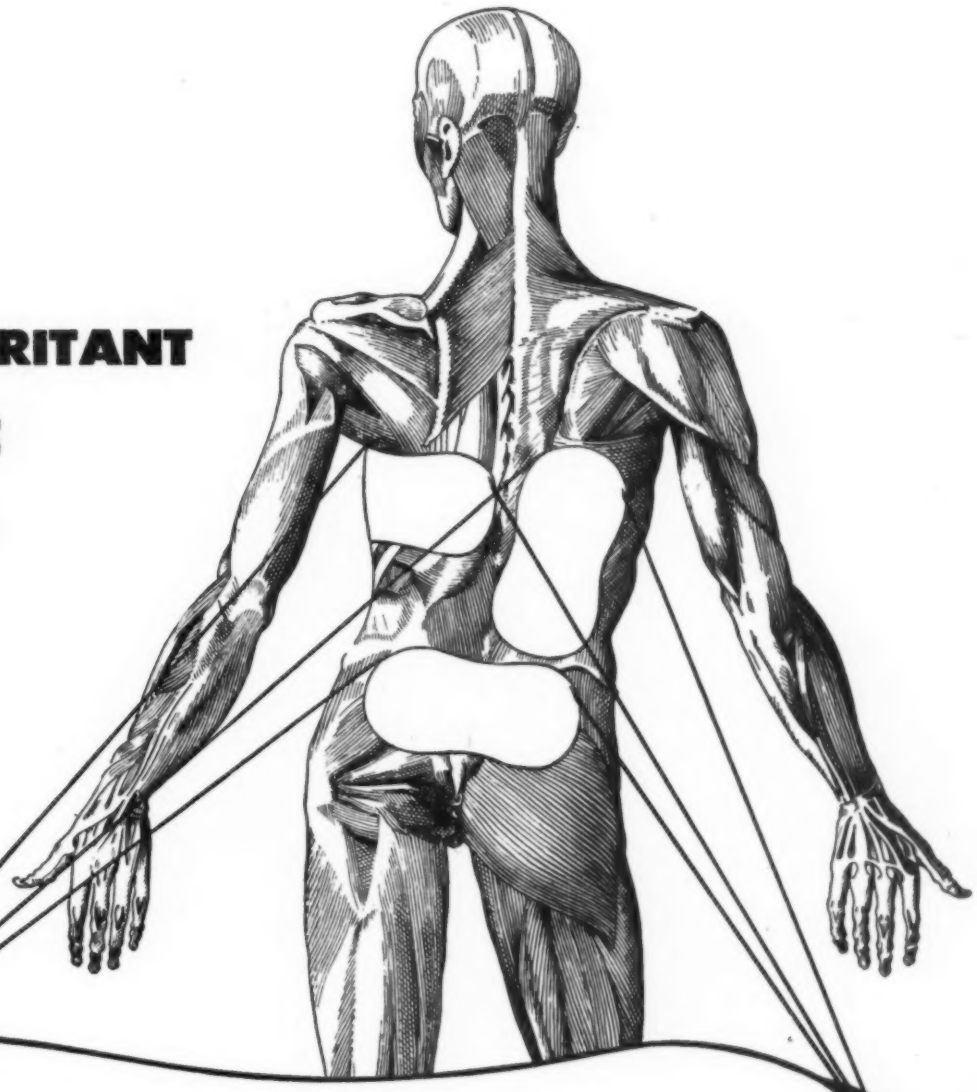

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WILLSON PROTECTO-SHIELD—Furnishes full-time safety for both front and sides of face. Lightweight, snug-fitting, comfortable. Tilted visor available in three lengths. Clear or Tru-Hue green plastic.

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READING, PA., U. S. A. Established 1870

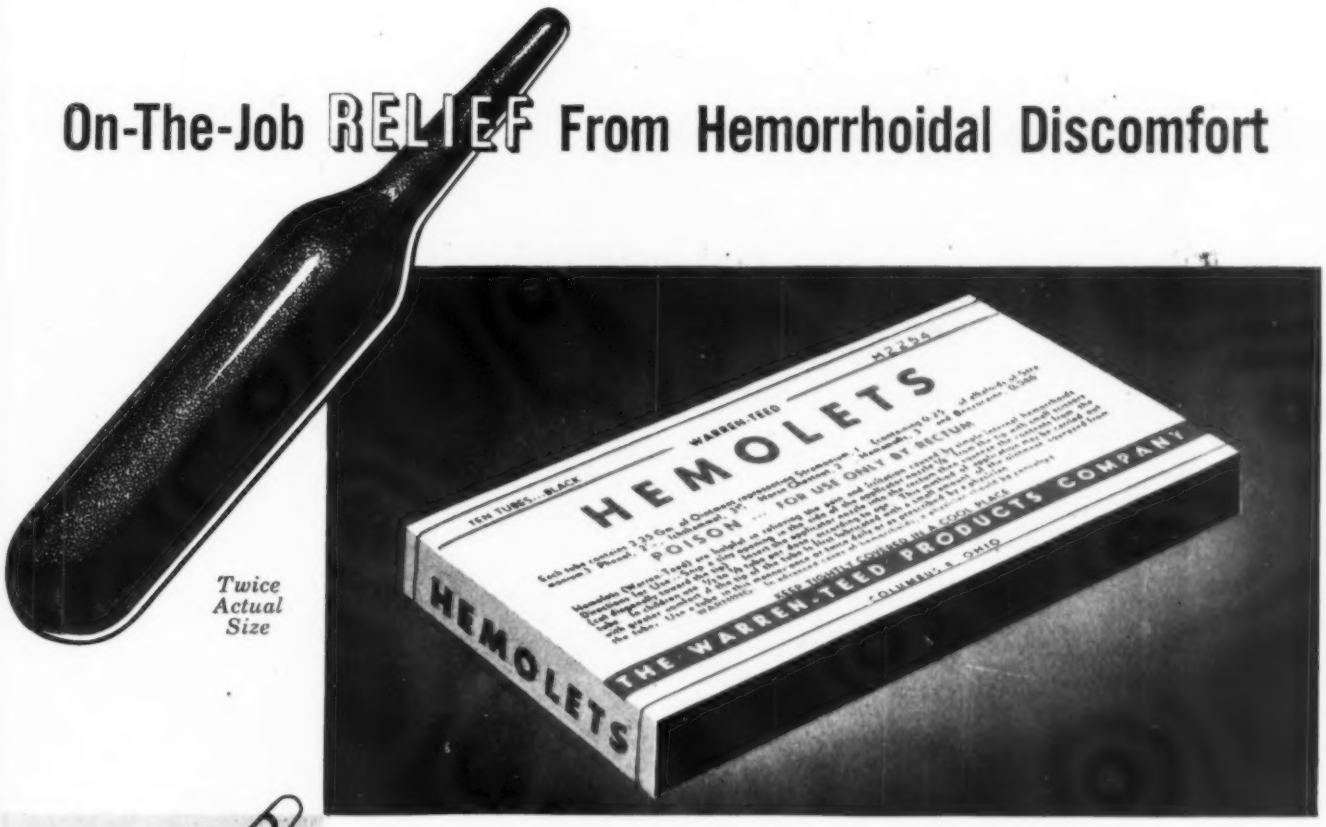
WE WERE astounded by the number of men blind by methyl alcohol. It would seem that methyl alcohol could be designated by some name which has no phonetic resemblance to ethyl alcohol. Also perhaps something could be done to camouflage the characteristic ethyl alcohol-like odor.

—From "Causes of Uniocular and Binocular Blindness," by CAPT. C. A. SWANSON (MC) USN, and LIEUT. R. A. STEWART, (MC) USNR, in *Sight-Saving Review*, Spring, 1946.

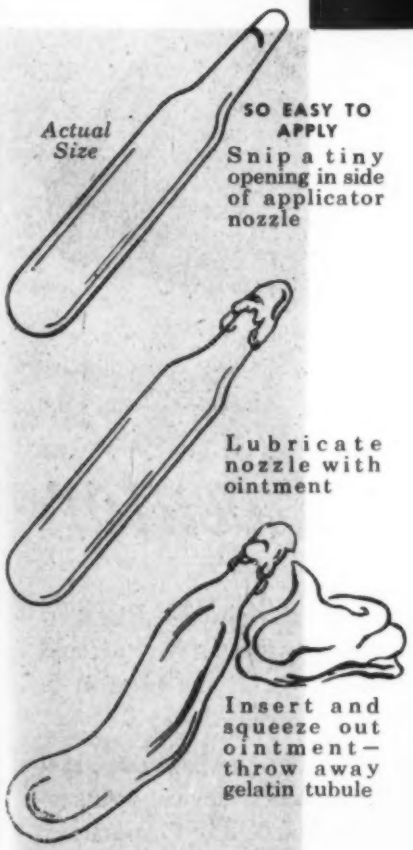
DR. PILGRIM

NOW concerned with many conferences and visits, among them with DR. JEAN FELTON on new plans for industrial medical departments, and BERT HANMAN relative to his European trip on vocational placement methods. . . . AND much reading of papers and abstracts, including one on Soviet medicine, which was of considerable interest, and preparation of lecture material for DR. RAYMOND HUSSEY's course at Wayne University, and writing many reports, and concentrating on survey material and finding many points of interest and utility which it is hoped will be the basis for the administrative health pattern for many years to come. . . . AND renewing friendships and talking of recent Bohemian Club experiences with the DE FREMERYS, stopping enroute to Mackinac for the Beta convention; and relaxing with music and mathematics with the XAVIERS, GARDINERS and SCHAPIROS; and listening with much interest to a series of excellent radio programs: Margaret O'Brien in "Our Vines Have Tender Grapes," a moving tale of Norwegian life with interludes of Grieg's music and reminding one of the Norwegian-American farmers in the midwest; and a mystery story from the "Case Book of Gregory Hood" in which a part of the story related to Dr. Saxton T. Pope, an expert on archery in real life (as in the story) and reminiscent of the times when "Sax" lived next door to Pilgrim's forbears at Watsonville, California, and figured prominently in California medical annals; and still another with Herbert Marshall as Jonathan Kent, depicting the trials of a pioneer obstetrician fighting the ignorance and superstitions of midwifery. . . . AND to southwest Missouri for inspections and study of munitions problems and later to a long series of trials of alleged occupational disease in which, as one of the observers said, the "supposition" question was asked as usual and covered many pages, and it appearing that there was considerable trouble in interpreting the professional testimony, especially for the plaintiff, what with osteopaths and chiropractors being involved. . . . AND, in the meantime, much concerned with survey material, and with other legal hearings for which preparation being made, and of which more later. . . .

On-The-Job RELIEF From Hemorrhoidal Discomfort



Twice Actual Size



Actual Size

SO EASY TO APPLY

Snip a tiny opening in side of applicator nozzle

Lubricate nozzle with ointment

Insert and squeeze out ointment—throw away gelatin tubule

Quick-Acting—Convenient

In a matter of minutes—a Warren-Teed HEMOLET alleviates the annoying, efficiency-reducing discomfort of hemorrhoidal pain. The single-dose tubule is convenient to use—its ingredients afford speedy relief. Prescribe convenient Warren-Teed HEMOLETS.

Each Warren-Teed HEMOLET contains 2.25 Gm. of ointment representing—

Stramonium 1% (containing 0.25% of alkaloids of Stramonium)—relief from pain. *Phenol 2%*—enhances analgesic properties, is antiseptic. *Ichthammol 3%*—promotes healing. *Horse Chestnut 2%*—astringent. *Hamamelis 3%*—astringent. *Benzocaine 0.046%*—effective local anesthetic.

WARREN-TEED

Medicaments of Exacting Quality Since 1920

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WARREN-TEED ETHICAL PHARMACEUTICALS: CAPSULES, ELIXIRS, OINTMENTS, STERILIZED SOLUTIONS, SYRUPS, TABLETS. WRITE FOR LITERATURE.

Presenting the Berman Locator

Following its dramatic Pearl Harbor debut, the Berman Metal Locator has fast become recognized as a valuable aid in the operating room. And you'll be interested in the reasons why:

No longer must time be spent in painstaking search for metallic foreign bodies embedded in tissues. With the reliable diagnostic information provided by the Berman Metal Locator, you can accurately localize the object. And, as the operation proceeds, you can explore the incision to determine whether or not displacement of the foreign body has occurred.

Accurate, efficient, and portable, the Berman Metal Locator provides both *visual* and *audible* indications to guide the surgeon in locating the foreign body.

For complete information about this modern, time-saving diagnostic device, write today to: General Electric X-Ray Corporation, 175 West Jackson Blvd., Chicago 4, Illinois. Address Department 2588.

GENERAL ELECTRIC X-RAY CORPORATION

for troubles that are skin deep...

Prescribe 'B·F·I' Antiseptic First-Aid Dressing and Surgical Powder . . . an efficient, antiseptic, dry, surgical dressing with protective, astringent, absorbent and soothing qualities . . . for the treatment of cuts, burns, abrasions, chafing, scratches and other minor wounds and skin irritations . . . also effective in the treatment of epidermophytosis (athlete's foot).

"B·F·I" powder

Antiseptic First-Aid Dressing and Surgical Powder

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Gentlemen: Without charge, please send me a clinical trial package of 'B·F·I' Powder.

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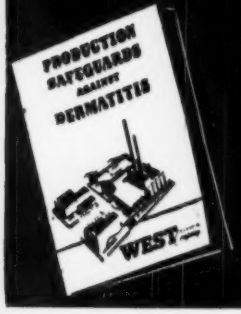
HOW MUCH PROTECTION?



While any cream may give some degree of protection, West makes a *series* of protective cream formulas because tests have shown that each specific hazard can be more adequately met when the protective cream used is formulated especially for that specific hazard.

There is a WEST Cream to Meet Your Industry's Particular Hazard

Compounded as a quick vanishing cream with sufficient oily residue to form a protective film against *salt solutions, mild alkaline and acid solutions, dust powders and certain irritating vapors*. Being a vanishing cream, it is soothing in application.

A vanishing cream which is generally used as a protection against *dusts, powders, heavy oils, greases*, but is less resistant to water vapors than West Protective Cream No. 11.

Designed to protect the skin against organic solvents such as *kerosene, gasoline, carbon tetrachloride, xylol, lacquer thinners, paints, enamels and lacquers*. Washes from skin readily with soap and water and does not dissolve in the organic solvents. This cream also protects the skin against dusts and certain vapors.

A heavy bodied cream possessing special cleansing ingredients as well as special materials scientifically combined to protect against *certain aqueous* and *alkaline solutions*.

This cream is primarily resistant against aqueous solutions and is recommended against *detergent solutions, alkaline solutions, cutting oils, vapors, dusts*, and such other harmful materials that would ordinarily penetrate through the aforementioned protective creams.

This cream contains Zinc Oxide and Benzoic Acid and is acid in reaction, being recommended against irritating alkaline conditions affecting the skin. While basically it functions as a cold cream, it is more specific for *alkaline conditions* than West Protective Cream No. 44.

Contains a chemical photodesensitizer, and a bland pigment to protect against the action of *Coal Tar Compounds, Petroleums, Tar, Pitch* and like substances, and is a protection against actinic rays when they act as an external irritant in conjunction with the above compounds.

This cream forms a homogeneous reinforced oxidizing film on the surface of the skin as a protection against toxic elements of explosives such as *Tetryl, TNT, DNT, Fulminate of Mercury, Lead Styphnate, Amatol, Dinitrophenol, Lead Azide*, etc.

WEST DISINFECTING *Company*

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Please send us your booklet "West Protective Creams."

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Protein as a Therapeutic Factor In Infectious Disease

In the recent past, increasing attention has been called to the influence of severe infections upon protein metabolism and the profound destruction of tissue and serum protein which occurs in these states.[1, 2]

In many instances, prompt control of infection by sulfonamides or penicillin is not followed by the desired degree of systemic improvement. Instead, protracted, stormy convalescence supervenes. A factor which is often responsible for delayed recovery is known to be the intense protein depletion which not only accompanies but also follows in the wake of infectious disease. Not infrequently, recovery can be sharply hastened by correction of existing nutritional deficiencies, foremost among them, protein deficiency. A protein intake, adequate both qualitatively and quantitatively, thus gains increasing significance as an integral part of therapy whenever the condition under treatment is known to lead to increased nitrogen excretion.

Among the protein foods of man meat ranks high, not only because it is rich in complete, biologically adequate protein, but also because its palatability and the many attractive ways it can be prepared make it acceptable to most patients.

---

[1] Tillett, W. S., Cambier, M. J., and McCormack, J. E.: The Treatment of Lobar Pneumonia and Pneumococcal Empyema with Penicillin, Bull. New York Acad. Med. *20*:142, March, 1944.

[2] Armstrong, S. H., Jr.; England, A. C., Jr.; Favour, C. B., and Scheinberg, I. H.: Anemia and Hypoproteinemia Complicating Severe Protracted Pneumonia: Treatment with Penicillin—Role of Specific Supportive Therapy in Recovery. J.A.M.A. *127*:303 (Feb. 10) 1945.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Foods and Nutrition

AMERICAN MEAT INSTITUTE

MAIN OFFICE, CHICAGO . . . MEMBERS THROUGHOUT THE UNITED STATES

NEW

A-O RUBBER FRAME GOGGLES

A-O Safety Goggles Safeguard the Eyes of Industry

Provide Maximum Protection Against Chemical and Dust Hazards . . .

The new A-O Rubber Frame Goggle has a single large acetate lens, which provides exceptional wide-angle vision. Frame is molded from non-irritating, acid-resisting synthetic rubber, which will stand up under long, hard wear. It is scientifically designed to conform to face contours, providing an acid- and dust-tight fit. Cushioned and ventilated for maximum comfort. Especially recommended for maintenance men on acid lines and storage batteries; for workers on metal plating baths, foundry shake-out, railroad car and coal handling apparatus cleaning, and in ship holds and engine cabs where dust is a dangerous factor. Send for bulletin which fully describes the various outstanding features of this new A-O development.

American Optical COMPANY *Safety Division*

SOUTHBRIDGE, MASSACHUSETTS
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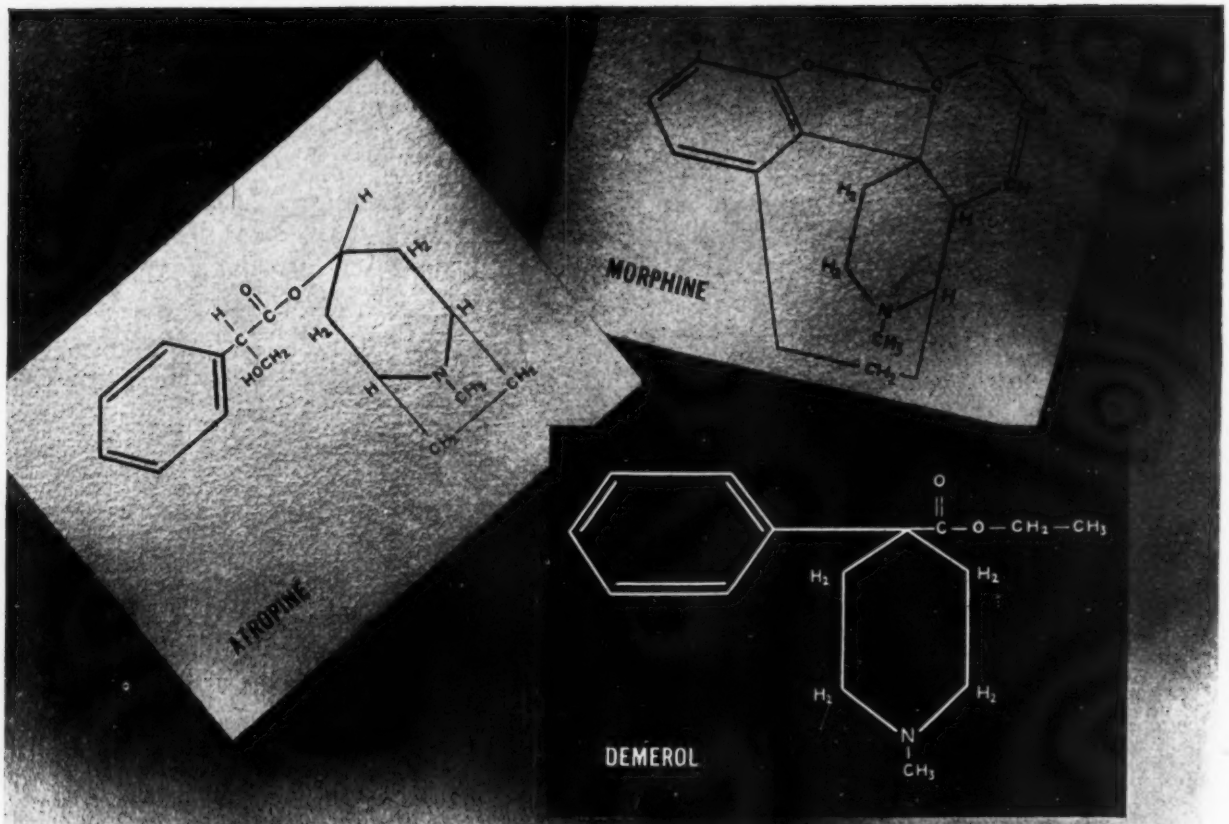

Chemical Relationship and Pharmacodynamic Similarity

A NEW SYNTHETIC

ANALGESIC — Demerol's analgesic power ranks between morphine and codeine.

SPASMOLYTIC — Demerol's spasmolytic action is similar to that of atropine.

SEDATIVE — Demerol's sedative effect is mild, but usually sufficient to allay restlessness and induce sleep.

PRACTICALLY NO RISK OF RESPIRATORY DEPRESSION

WRITE FOR DETAILED LITERATURE

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HYDROCHLORIDE

Brand of MEPERIDINE HYDROCHLORIDE
(Isonipecaine)

Average adult dose: 100 mg. orally or intramuscularly.

HOW SUPPLIED — For oral use: Tablets of 50 mg., bottles of 25 and 100. For intramuscular injection: Ampuls of 2 cc. (100 mg.), boxes of 6 and 25, and vials of 30 cc. (50 mg. per 1 cc.).

Subject to regulations of the Federal Bureau of Narcotics

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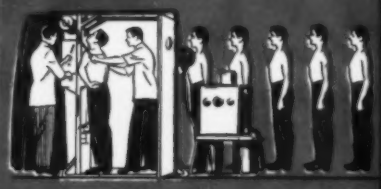
Pharmaceuticals of merit for the physician • New York 13 N. Y. • Windsor, Ont.

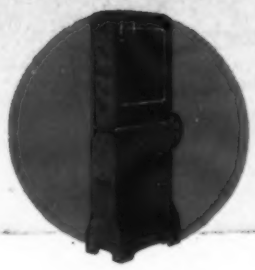
POWERS PRESENTS

As Part of a Complete X-Ray Service



CASE-FINDING TEAMS

USING mobile, modern equipment, *Powers Case-Finding Teams* operate anywhere in the country. The equipment, employed by trained technicians, is set up at a convenient spot within the sponsor's building. It uses regular 220 volt, A.C. power, and provides full size 14" x 17" radiographs. This convenient method permits group case-finding operations with a minimum of trouble and loss of time, and at unusually low cost. Other features of the complete Powers X-Ray Service are:



POWERS MAGAZINE CASSETTE, loaded in the same manner as an ordinary camera with Powers X-Ray Paper. As many as 50 radiographs can be made without reloading or changing cassette. The cost is small since the equipment is loaned by the company.

POWERS X-RAY PAPER, in standard cut sheet sizes, provides economical x-rays of high diagnostic quality. More than 4,500,000 chest radiographs have been made on Powers X-Ray Paper in the past 13 years.

For full details on the complete Powers X-Ray Service, or any one feature of it, write to

Over half a million chest x-rays taken last year on Powers X-Ray Paper

POWERS X-RAY PRODUCTS

POWERS X-RAY PRODUCTS, Inc.

Glen Cove, L. I., N. Y.

Group Radiography

HANDS LIKE THESE

could have been saved with

PLY

PROTECTIVE CREAM

Safeguard

AGAINST MORE THAN 2000 CRIPPLING SKIN HAZARDS

PLY
NO. 2
An emollient. Contains synthetic resin, vegetable gum, ultra violatum in vanishing cream base.
THE MILBURN COMPANY • DETROIT, MICH

Write today . . . for the only reference of its kind in America! Get the new enlarged 14th edition of "The answer to Industrial Dermatitis". Detailed information as to more than 2,000 skin irritants, classified by common chemicals, trade names and industries. Recommended PLY PROTECTION, cream or liquid, to combat each skin hazard, is clearly indicated. This is indispensable information. Write for your copy on company letterhead without fail today . . . No obligation!

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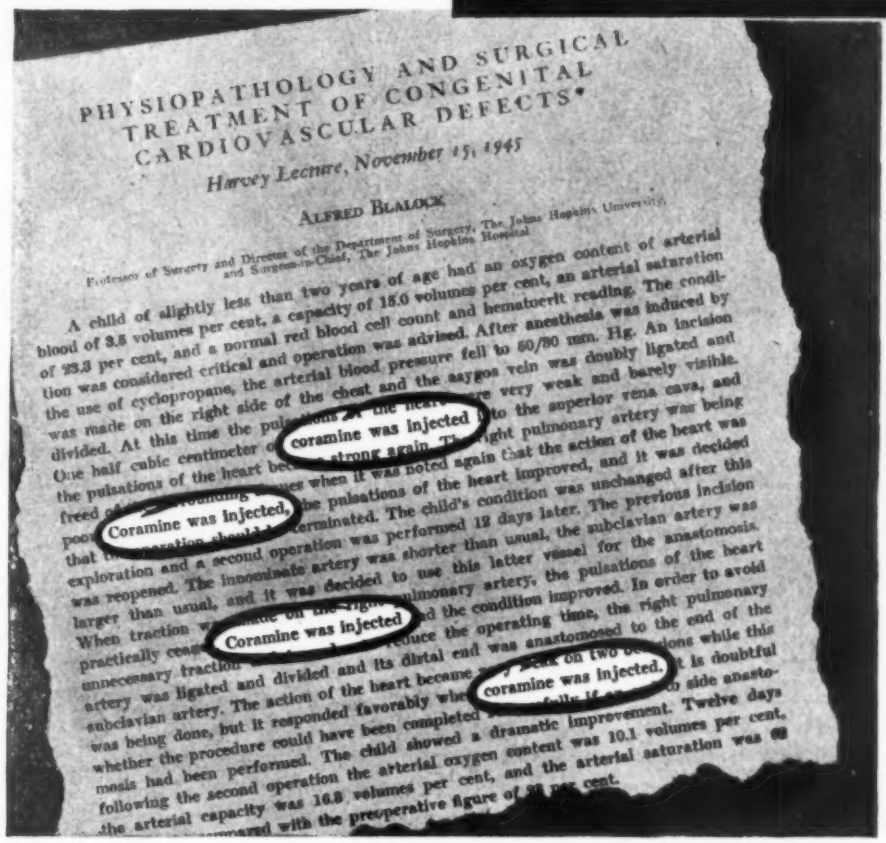
CORAMINE

CIBA'S WELL RECOGNIZED RESPIRATORY STIMULANT



PHYSIOPATHOLOGY AND SURGICAL TREATMENT OF CONGENITAL CARDIOVASCULAR DEFECTS*

Harvey Lecture, November 15, 1945

ALFRED BLALOCK

Professor of Surgery and Director of the Department of Surgery, The Johns Hopkins University, and Surgeon-in-Chief, The Johns Hopkins Hospital

A child of slightly less than two years of age had an oxygen content of arterial blood of 3.5 volumes per cent, a capacity of 15.0 volumes per cent, an arterial saturation of 23.3 per cent, and a normal red blood cell count and hematocrit reading. The condition was considered critical and operation was advised. After anesthesia was induced by the use of cyclopropane, the arterial blood pressure fell to 50/30 mm. Hg. An incision was made on the right side of the chest and the azygos vein was doubly ligated and divided. At this time the pulsations of the heart were very weak and barely visible. One half cubic centimeter of coramine was injected into the superior vena cava, and the pulsations of the heart became strong again. The right pulmonary artery was being freed of [illegible] when it was noted again that the action of the heart was poor. Coramine was injected, and the pulsations of the heart improved, and it was decided that no operation should be terminated. The child's condition was unchanged after this exploration and a second operation was performed 12 days later. The previous incision was reopened. The innominate artery was shorter than usual, the subclavian artery was larger than usual, and it was decided to use this latter vessel for the anastomosis. When traction was made on the right pulmonary artery, the pulsations of the heart practically ceased. Coramine was injected, and the condition improved. In order to avoid unnecessary traction [illegible] reduce the operating time, the right pulmonary artery was ligated and divided and its distal end was anastomosed to the end of the subclavian artery. The action of the heart became poor [illegible] coramine was injected. It is doubtful was being done, but it responded favorably when [illegible] to side anastowhether the procedure could have been completed [illegible] falls if so mosis had been performed. The child showed a dramatic improvement. Twelve days following the second operation the arterial oxygen content was 10.1 volumes per cent, the arterial capacity was 16.8 volumes per cent, and the arterial saturation was 60 [illegible] compared with the preoperative figure of 23 per cent.

During prolonged surgery in poor risk patients it is not unusual for Coramine to be used several times. The number of such reports indicating dramatic life-saving results is very gratifying to the surgeon who has learned to depend on Coramine in such emergencies.

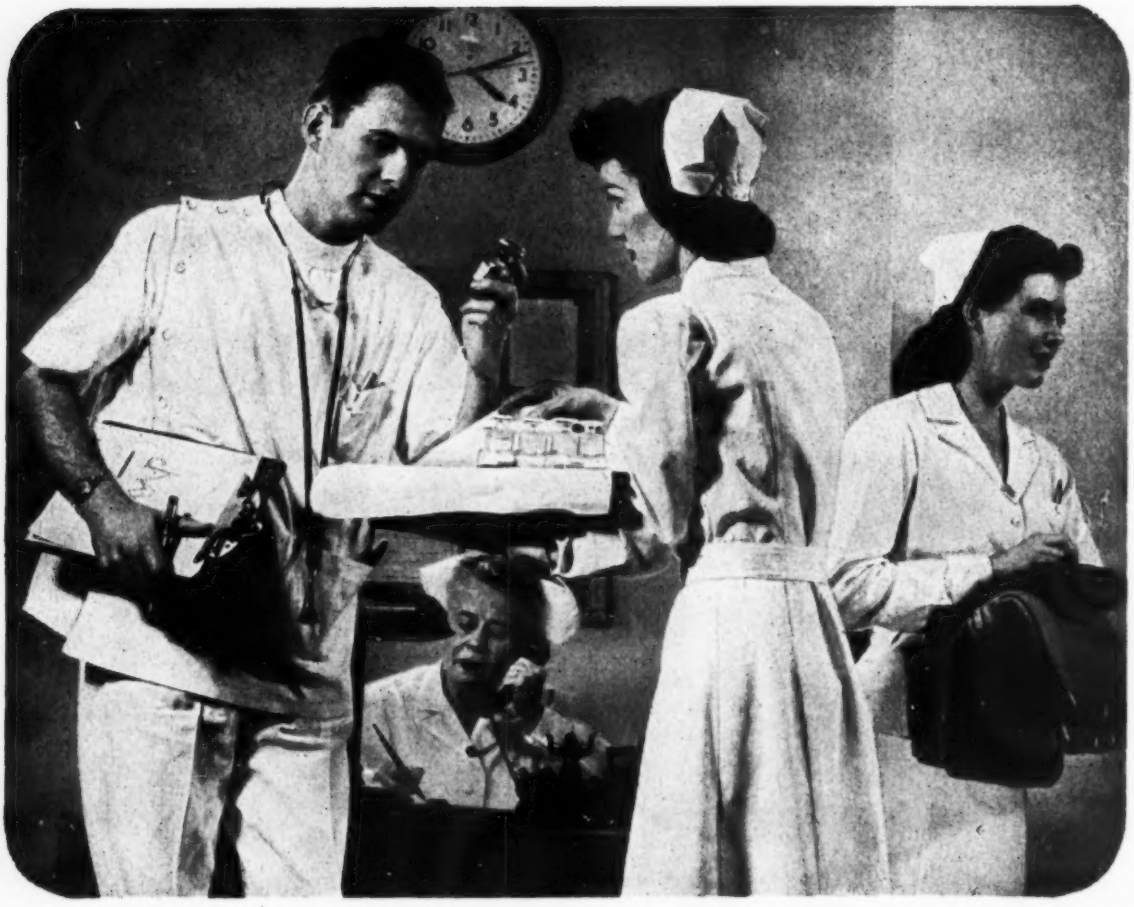
CIBA

AVAILABLE . . . . . Ampuls of 1.5 cc.
Ampuls of 5 cc.

For oral administration . . . Liquid in 3 ounce bottle
16 ounce bottle
32 ounce bottle

CIBA PHARMACEUTICAL PRODUCTS, INC., SUMMIT, NEW JERSEY

In Canada: **Ciba Company Limited, Montreal**



Young Man in White

● You may call him an "interne," but in name and in fact he's every inch a doctor.

He has his textbook education . . . his doctor's degree. But, in return for the privilege of working side by side with the masters of his profession, he will spend a year—more likely two—as an active member of a hospital staff.

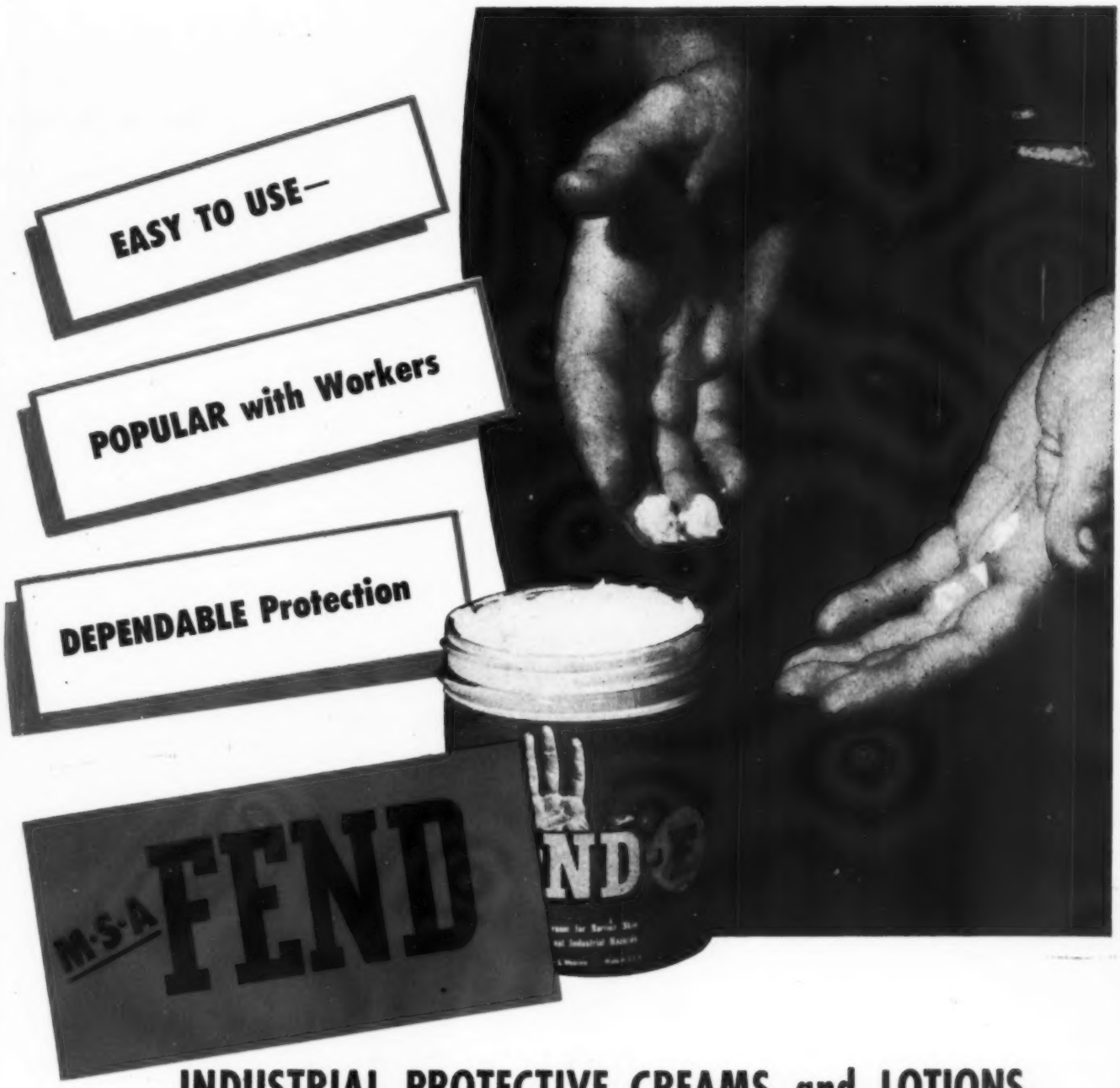
His hours are long and arduous . . . his duties exacting. But when he finally hangs out his coveted shingle in private practice he will be *a doctor with experience!*

According to a recent independent nationwide survey:

More Doctors Smoke Camels

than any other cigarette

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.



INDUSTRIAL PROTECTIVE CREAMS and LOTIONS

Each Fend Cream and Lotion incorporates all the basic advantages which appeal to workers. These are the *protective value* of Fend, the light texture and clean fragrance which make Fend pleasant to use, and its long-lasting effective barrier during the work period. Each Fend formula is *bland and neutral* in composition, emollient, non-irritating, harmless to the most sensitive skin. The user finds Fend products *easy to apply;* Fend rubs in quickly, and is *readily removed* when work is finished with mild soap and warm water.

Are you familiar with the technical features of Fend Creams and Lotions? Write for your copy of the informative Fend Brochure!

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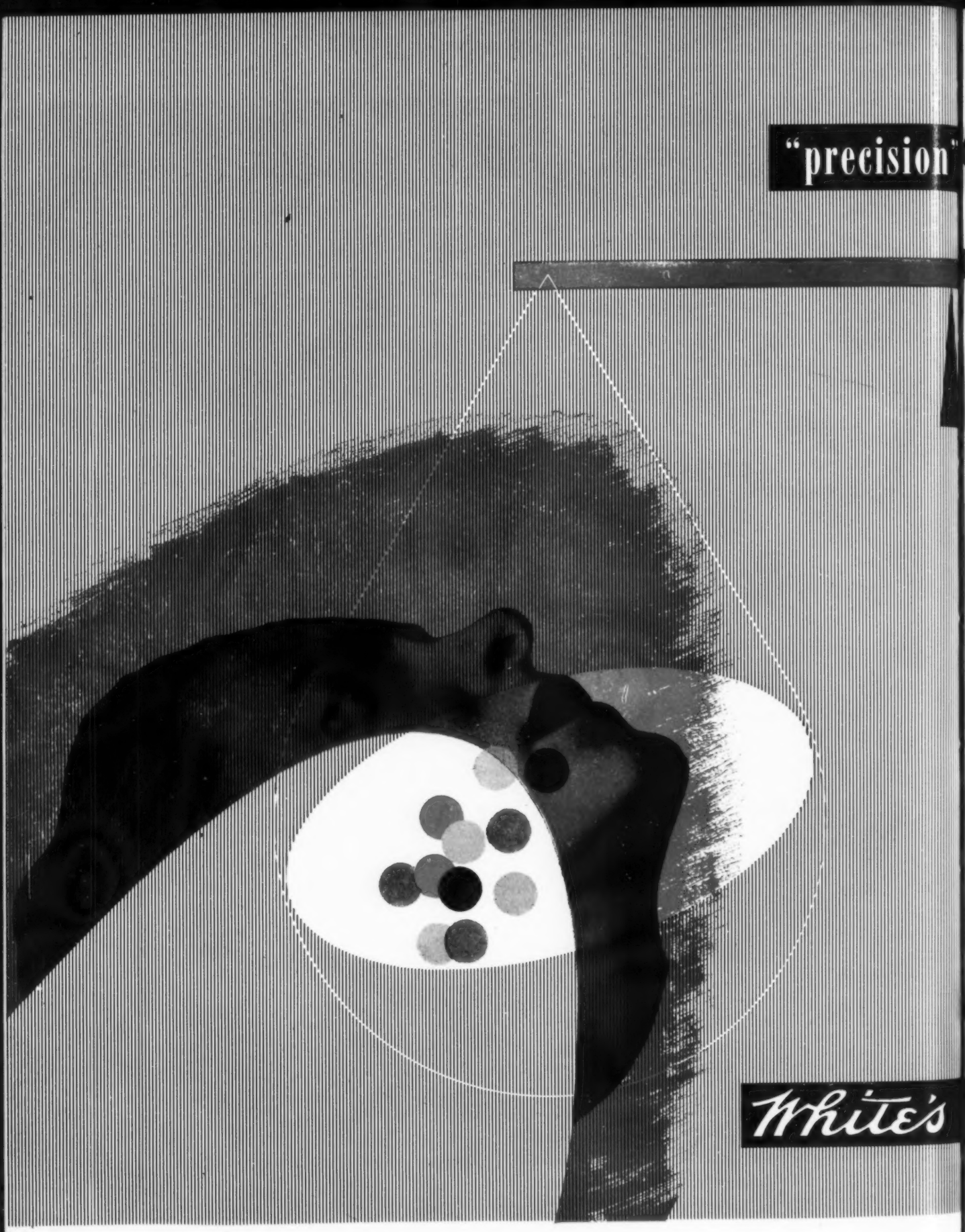
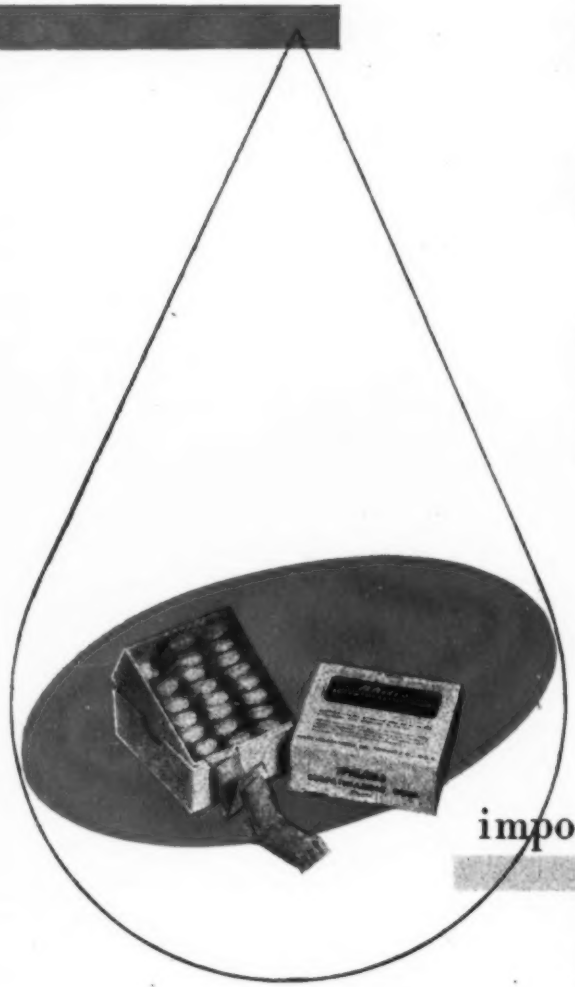


* A PRODUCT OF

White LABORATORIES, INC. Pharmaceutical Manufacturers, Newark 7, N. J.

chemotherapy in oral and pharyngeal infections



1. Provides prompt, long-sustained and high salivary concentration of sulfonamide, maintained in intimate contact with entire oropharyngeal area.

2. Yet *systemic* absorption, even with maximal dosage, is negligible (commonly even immeasurable) virtually obviating likelihood of systemic toxic reactions.

3. The product retains full potency under all ordinary conditions.

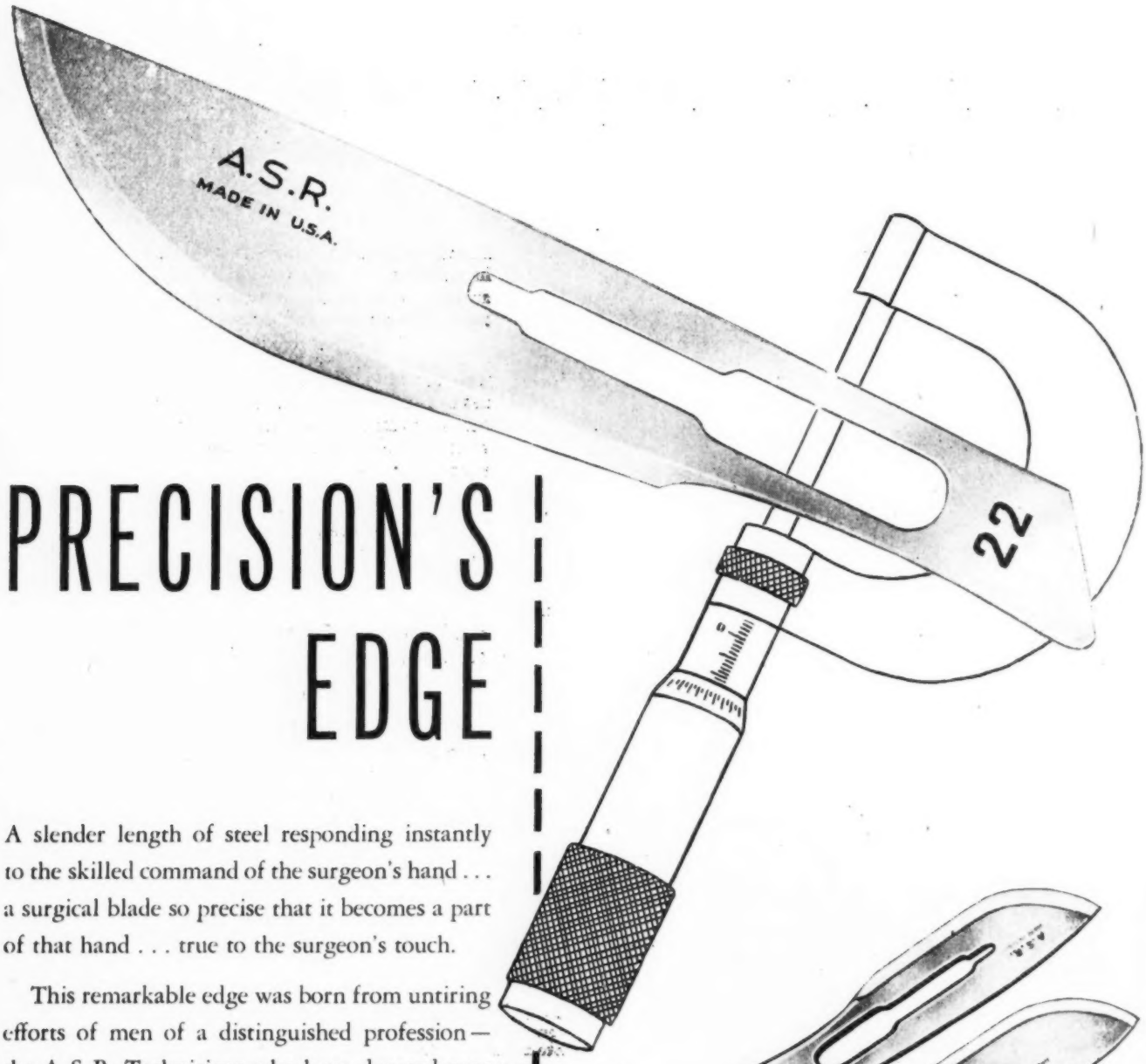
4. Its clinical value has been clearly established in a substantial and fast growing literature, and in notably extensive professional experience.

Supplied in packages of 24 tablets—3¾ grs. (0.25 Gm.) per tablet—sanitaped, in slip-sleeve prescription boxes.

important

Please note that your patient requires your prescription to obtain this product from the pharmacist.

*Sulfathiazole gum



PRECISION'S EDGE

A slender length of steel responding instantly to the skilled command of the surgeon's hand . . . a surgical blade so precise that it becomes a part of that hand . . . true to the surgeon's touch.

This remarkable edge was born from untiring efforts of men of a distinguished profession—the A. S. R. Technicians who have devoted over fifty years to doing one thing right . . . creating precision edges of Micrometer accuracy—edges worthy of the fullest confidence.

★

A. S. R. Surgical Blades are preferred by surgeons because of their exacting balance . . . their true sense of "feel" blade after blade.

Available in 9 sizes to fit all Standard Surgical Handles

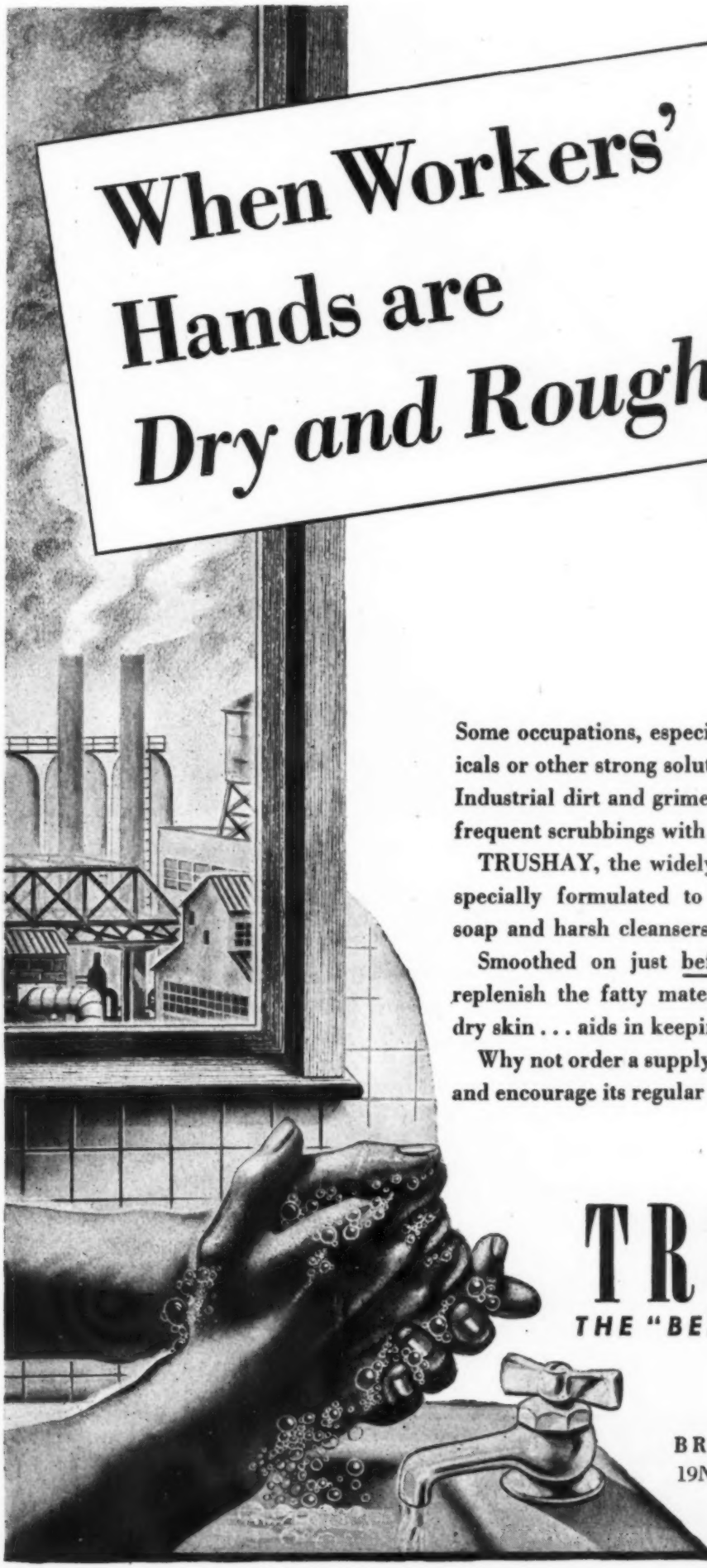
A.S.R.
REG. U.S. PAT. OFF.

Surgeon's Blades and Handles

SURGICAL DIVISION, AMERICAN SAFETY RAZOR CORPORATION, BROOKLYN 1, NEW YORK

Makers of Fine Edges for Over Half a Century

When Workers' Hands are Dry and Rough



Some occupations, especially those involving use of chemicals or other strong solutions, are hard on workers' hands. Industrial dirt and grime also tend to defat the skin, as do frequent scrubbings with strong soaps or scouring powders.

TRUSHAY, the widely-used "Beforehand" Lotion, was specially formulated to minimize the drying effects of soap and harsh cleansers.

Smoothed on just before washing, TRUSHAY helps replenish the fatty materials needed to overcome rough, dry skin . . . aids in keeping hands soft, smooth and supple.

Why not order a supply of TRUSHAY for the dispensary and encourage its regular use by the workers in your plant?

TRUSHAY

THE "BEFOREHAND" LOTION

A Product of
BRISTOL-MYERS COMPANY
19NE W. 50th St., New York 20, N. Y.

Even the Highest Skills...
Require the Best of "Tools"

THE SKILLED HANDS of the great surgeon are deserving of the finest instruments — tools of superior craftsmanship. Likewise the roentgenologist insists on the best tools of *his* specialty, so necessary to produce the ever important radiograph of high diagnostic quality.

That is why most of the world's roentgenologists rely on Patterson Intensifying Screens. That is why Patterson has been the standard of screen quality for more than 30 years. Your dealer has a complete stock. Patterson Screen Division of E. I. du Pont de Nemours & Co. (Inc.), Towanda, Pennsylvania.

DU PONT

BETTER THINGS FOR BETTER LIVING
... *THROUGH CHEMISTRY*
(Listen to "Cavalcade of America"—Monday Evenings, NBC)

Patterson Screens
The Standard of Screen Quality

It saves busy doctors extra trips to homes

It's easy for your patients to follow out home applications of Adaptic—the Johnson & Johnson Elastic Bandage:

1. **Adaptic is made to stretch without narrowing when wound. The finest long-staple cotton gives it extra elasticity.**

2. **Consequently, it rolls smoothly without reversing—easy for untrained hands. Will not ravel.**

3. **It's cool and fits comfortably.**

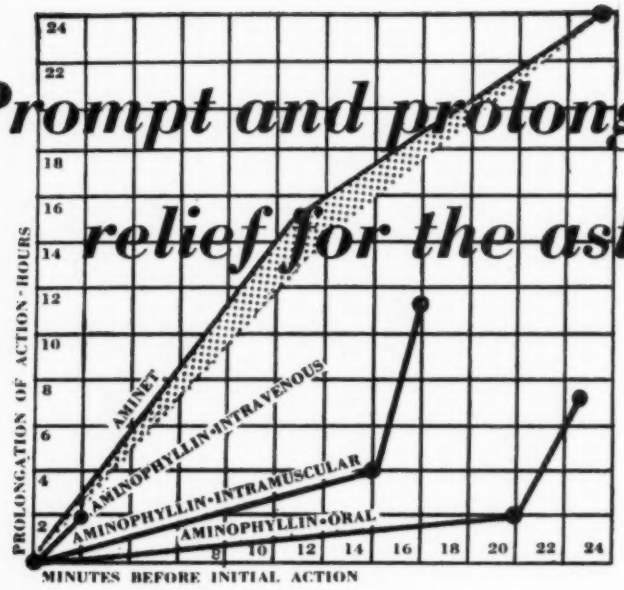
Simple home laundering restores the elasticity of Adaptic. So it can be reused many times, making its cost comparatively low. Available in 2", 2½", 3" and 4" widths.

ADAPTIC

the Johnson & Johnson

ELASTIC BANDAGE

Prompt and prolonged relief for the asthmatic



Readily available and easily administered even in the absence of a physician, AMINET *Suppositories* assure prompt relief. Relaxation of bronchial musculature—quickly achieved and effectively maintained—together with proper sedation prevents subsequent paroxysms.

AMINET *Suppositories*

provide a practical method for the administration of aminophylline and sodium pentobarbital in acute bronchial asthma, cardiac asthma (paroxysmal nocturnal dyspnea), seasonal asthma and Cheyne-Stokes respiration.

AMINET *Suppositories*, full strength (adult) and half strength (infant); boxes of 6 and 12.

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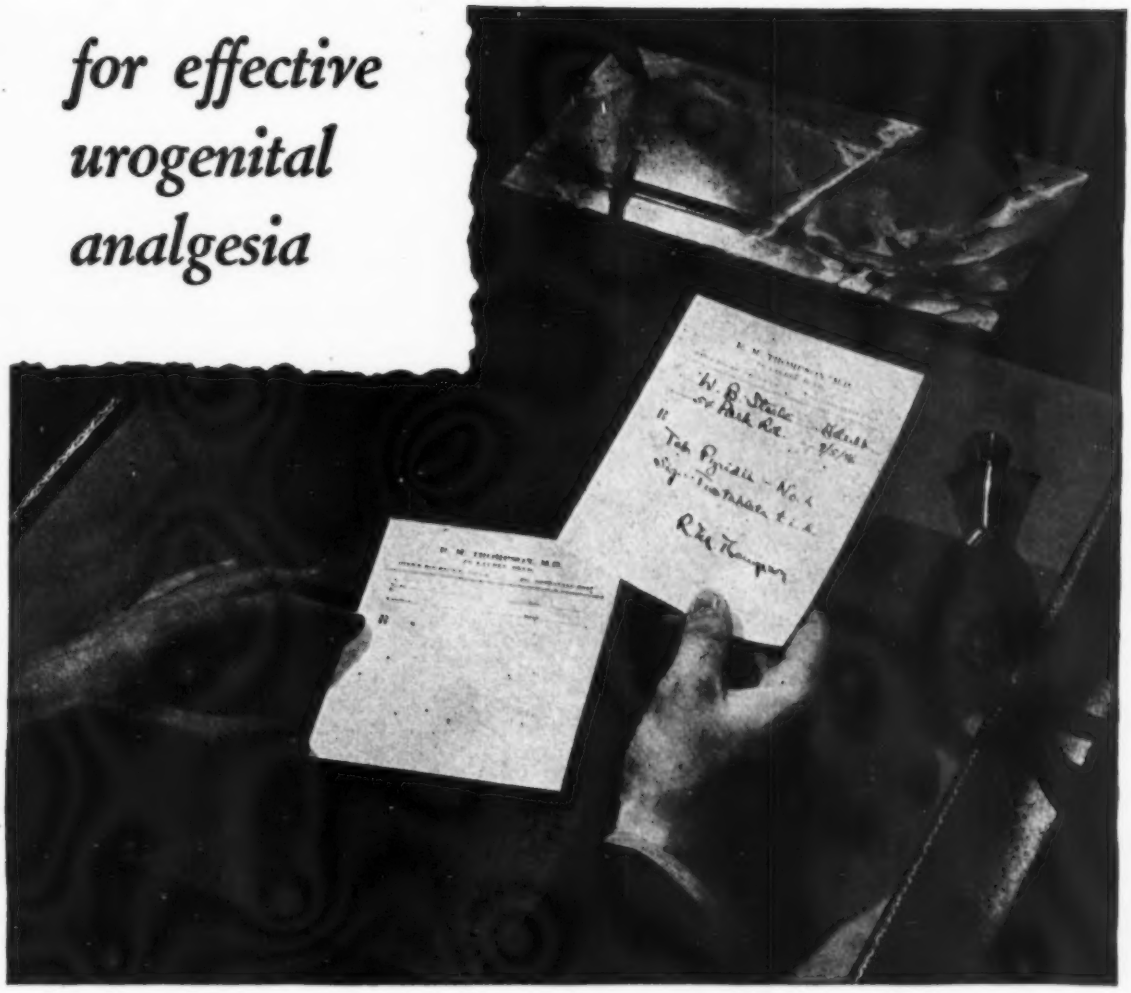

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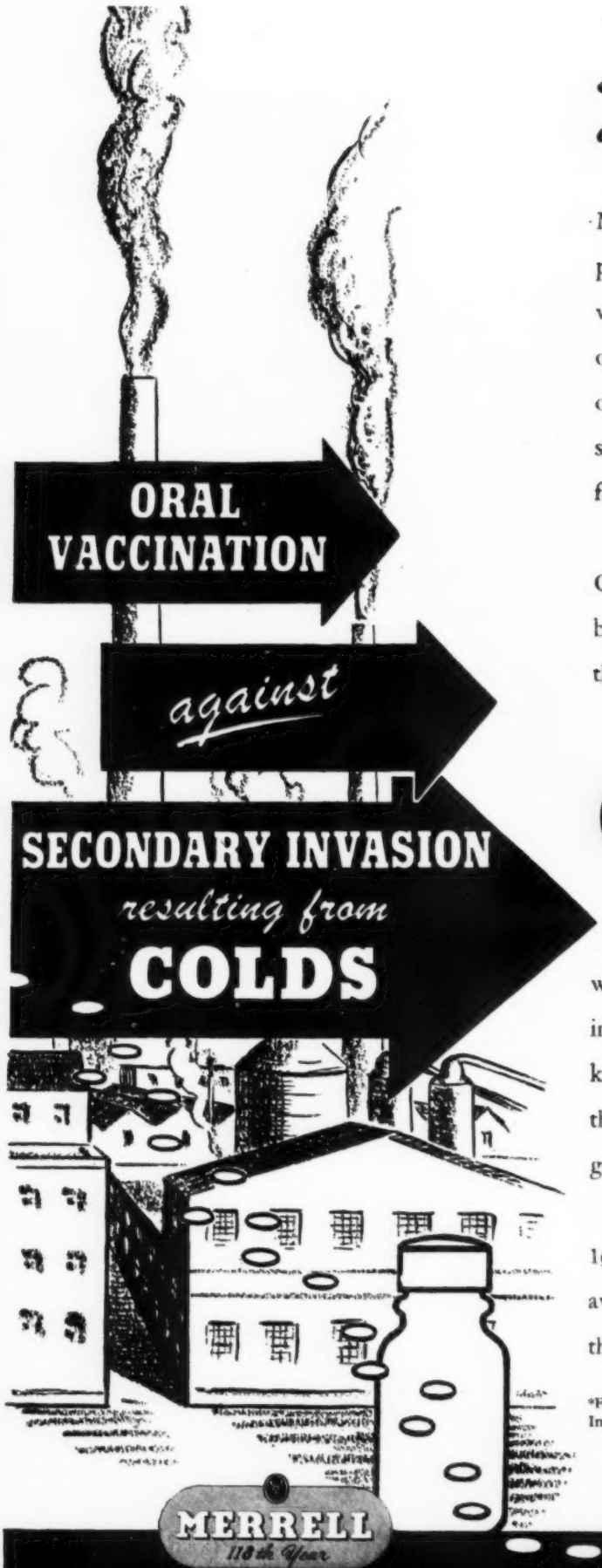

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*Forgrave, P., and Forgrave, J.: The common cold, prophylaxis by the oral route. Indust. Med. 9:530-533 (1940).

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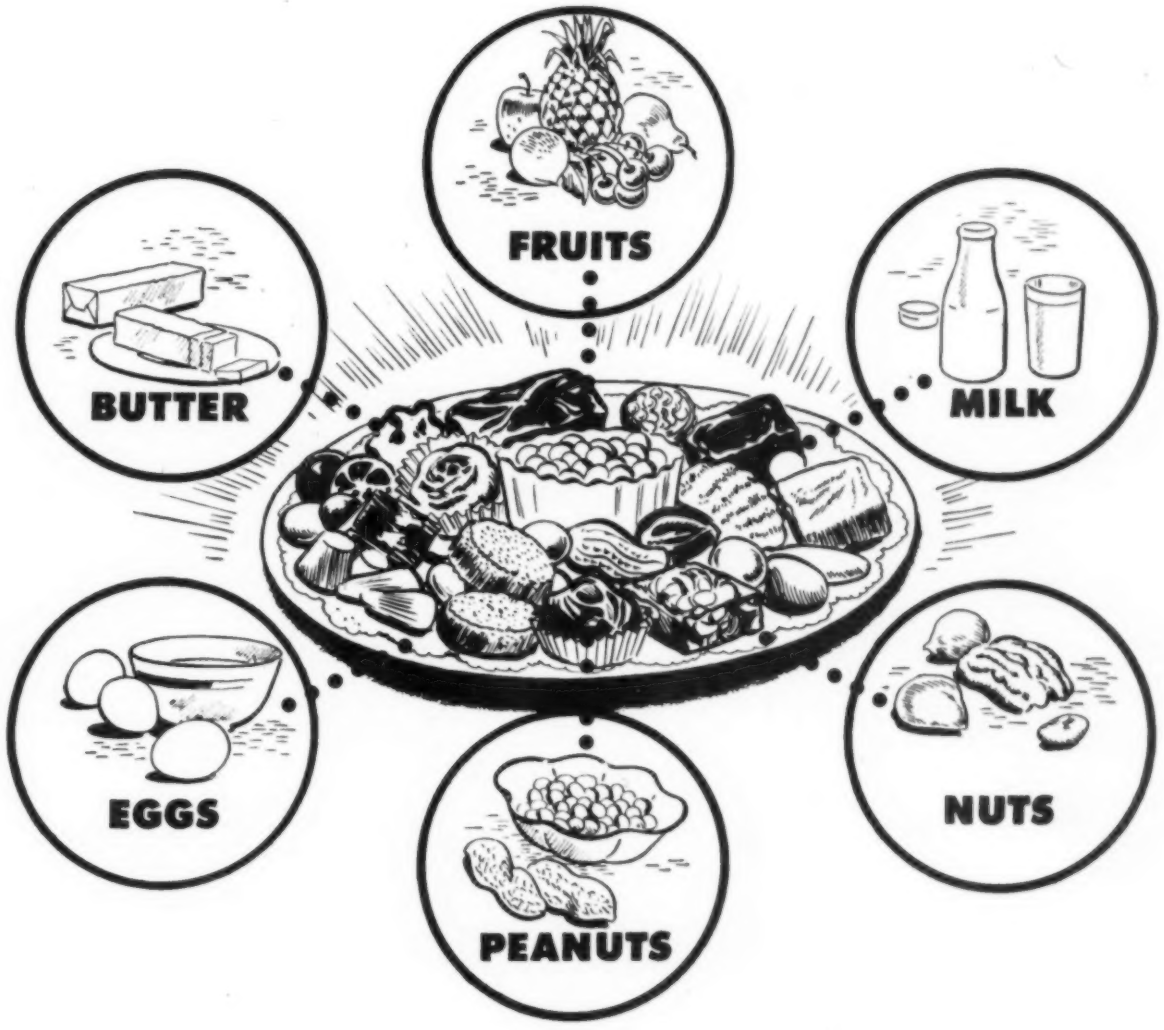

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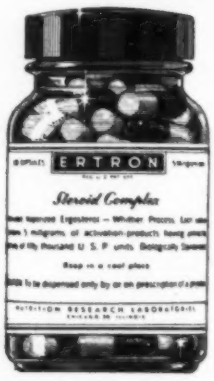

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Parenteral for supplementary injection.

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Steroid Complex, Whittier

. . . your arthritic patient receives the preparation that is . . .

. . . THERAPEUTICALLY EFFECTIVE

The effectiveness of steroid therapy in arthritis with Ertron has been established through a large bibliography of published articles and reports.

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For more than twelve years Ertron—Steroid Complex, Whittier—has been the subject of research in leading hospital and university clinics and in private practice.

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Physician control of the arthritic patient is essential for optimum response. When the results attainable through steroid therapy in arthritis are desired, it is important to *prescribe* Ertron, as it is made available to the patient only upon *written prescription.*

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1. Macht, D. I. and Nelson, D. E.: The Antiseptic Action of Benzyl Alcohol, Proc. Soc. Exp. Biol. Med., 16:25-26 (1918).
2. Macht, D. I.: Pharmacological and Therapeutic Study of Benzyl Alcohol as a Local Anesthetic, J. Pharmacol., 12:263-279 (1918)
3. Macht, D. I.: Further Experiences with Benzyl Benzoate and Benzyl Alcohol, Pharmacol. Proc., 13:509 (1919)
4. Sollmann, T. (Western Reserve Univ.); The Anesthetic Efficiency of Benzyl Alcohol for Mucous Membranes, J. Pharmacol., 13:355-360 (1919)

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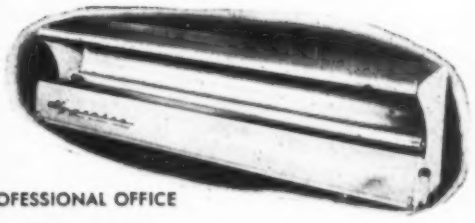

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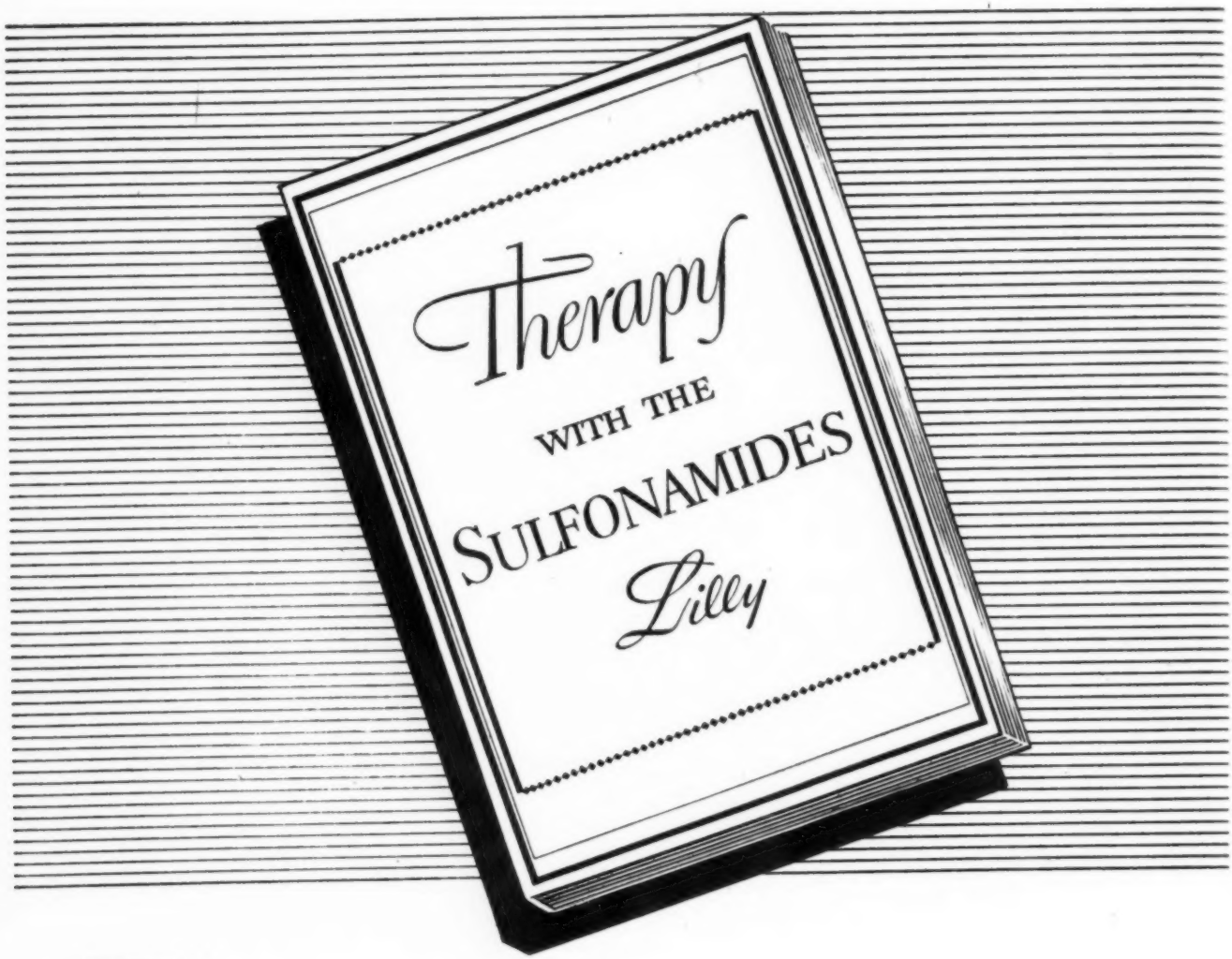

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In 1937 sulfanilamide was introduced into general clinical use. During the next six years sulfapyridine, sulfathiazole, sulfadiazine, and sulfamerazine followed in rapid succession. The vast clinical literature which has accumulated in the interval has been carefully organized and condensed by the Lilly Research Laboratories into an eighty-three-page book entitled *Therapy with the Sulfonamides*. A bibliography of 323 references is included. The discussion is divided between systemic and local administration. Many helpful charts, including "Sulfonamides in Order of Choice for Systemic Use," "Dosage of Sulfonamides for Adults," and "Dosage of Sulfonamides for Infants and Children," are included. Request a free copy of *Therapy with the Sulfonamides* from the Lilly medical service representative or direct from Indianapolis. Sulfonamides, Lilly, for systemic and local administration are provided in a complete variety of dosage forms, subject to your specifications.

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This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests, and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg. U. S. Pat. Off.

The editors will exercise care in checking on the accuracy of data printed but in all other respects articles and opinions of which expression is allowed are the opinions of their authors—the editors reserving in all cases the right to comment on the same in the current or any subsequent issues as they may be inclined.

The Journal of Industrial Health, Occupational Medicine and Traumatic Surgery

With which are consolidated "The Industrial Doctor" and "International Journal of Medicine and Surgery."

The Science, the Law and the Economics of Industrial Health

Volume 15 | October, 1946 | Number 10

GENERAL MOTORS MEDICAL CONFERENCE

— Rochester, New York, July 29-30-31, August 1-2, 1946—

DELCO Appliance Division and Rochester Products Division of General Motors Corporation were the 1946 hosts of the Ninth General Motors Medical Conference, in Rochester, New York, July 29 to August 2. The Monday morning session, with DR. EDWIN J. NUGENT as Chairman (see the Program on the next page) was held at Rochester Products Division; the Monday afternoon meeting, with DR. BRUCE LARGE presiding, was at Delco Appliance Division; and the Monday evening session, reception and banquet, took place at Hotel Sheraton.

A feature of the Monday evening gathering was the presentation of Continuous Service Awards to DR. A. WILLIS HUDSON and DR. MAHLON R. SUTTON, in recognition of the completion of long service with General Motors. DR. HUDSON has been affiliated with the Chevrolet Gear and Axle Division for 31 years, and DR. SUTTON has been with the Buick Motor Division for more than 30 years. Both medical directors began their industrial careers when industrial preventive medicine was in its infancy, and contributed extensively to procedures which provided greater protection for the health and safety of employees. DR. HUDSON introduced pre-employment medical examinations as one of his early innovations, promoting selective placement of applicants. He developed an ambulatory splint for leg fractures, and was successful in the employment of pinch skin grafting for large areas. DR. SUTTON obtained for Buick one of the earliest industrial x-ray installations, and initiated periodic chest examinations as early as 1920 for employees in particularly dusty occupations. He pioneered several accepted methods of bone surgery, and was responsible for the development of portable, hand-held eye magnets and the use of salt tablets for forge and foundry employees long before salt dispensers were known. The illustration (page 569) shows the presentation by DR. EDWIN NUGENT, General Chairman of the Conference, and DR. EARL F. LUTZ, Associate Medical Consultant, Central Office, who assisted DR. SELBY with the arrangements.

EDWIN J. NUGENT, M.D.,
Medical Director,
Rochester Products Division, and
General Chairman,
General Motors Medical Conference

Preceding the presentation, DR. WILLIAM S. McCANN, Dewey Professor of Medicine at the University of Rochester, welcomed the Conference to the University; and following the presentation, DR. C. D. SELBY, Chief Medical Consultant, talked on "The Impact of Reconversion on the General Motors Health Maintenance Program."

The sessions on Tuesday, Wednesday, Thursday and Friday were held at the University of Rochester School of Medicine and Dentistry, with subjects and lecturers as shown in the program.

On Thursday evening, at the Rochester Chamber of Commerce, there was a combined banquet of the General Motors Club of Rochester and the General Motors Medical Staff. MR. E. A. HALBLEIB, general manager of Delco Appliance Division was Chairman, and the speaker of the evening was MR. C. F. KETTERING, general manager of the Research Division and General Motors vice-president.

The following pages present the full texts of the Monday lectures by DRS. SAMUELSON, FERLAINO, BROWN, DIERKER and WILLIAMS. These are followed by MR. KETTERING'S talk on "Medicine and Research," given Thursday evening. Then come the abstract summaries, prepared by their respective authors, of the lectures of the succeeding days. The abstracts begin with DR. McCANN'S "Integration of Medical Services."

GENERAL MOTORS MEDICAL CONFERENCE

—Rochester, New York, July 29-August 2, 1946—

The Necessity for Having a Definite Schedule for Periodic Re-examination of All Employees including Salaried Group and Management Group

C. L. SAMUELSON, M.D.,
Medical Director,
Harrison Radiator Division,
General Motors Corporation,
Lockport, New York

FOR SOME time industry has recognized that periodic examinations are necessary for the maintenance and protection of the employee's health and safety.

There have been two recent factors, as a result of the war, which tend to increase the importance and the necessity of these re-examinations.

The first is the employment, in large numbers, of people who have physical conditions or handicaps which previously might have barred them from industrial employment. It has been found that under appropriate control these so-called "restricted employees" do have a productive capacity sufficiently great to justify their continued employment.

The second factor has been the introduction of new substances, some of which are known to be toxic or irritating, and others for which the toxicity and other effects of exposure are yet to be determined.

If we as industrial physicians are to carry out a sound industrial health program, and also safeguard the employer's liability, we must examine these restricted employees sufficiently often to see that there has been no change in their status as the result of their employment; secondly, examine all employees exposed to potential occupational disease hazards at sufficiently frequent intervals to insure control of their working conditions; third, examine all employees at reasonable intervals. Obviously, these three re-examinations might overlap.

At the risk of appearing to digress from the subject assigned, I would like to express as my personal conviction that back of such a program the industrial physician must have a thorough knowledge of plant conditions, exposures, and their significance. He cannot rely on the general physical examination alone, but in many instances where there are toxic substances, must make use of special examinations to determine if there have been any results of the exposure.

These examinations must be performed on a definite schedule because only by so doing can the employee's health and safety be adequately protected, the work load of the industrial physician and his department be controlled, and the program carried out with minimum interruption of the work of the department to which the employee is assigned. As to the latter, it is necessary to consult with department heads as to the time that they can best spare the employee for the examination. There is also one other reason for the necessity of having a definite schedule of examinations, and that is it gives to the employee a feeling of safety in his employment and the knowledge that the industry for which he works is concerned in his well-being. This has a marked influence on the employee morale.

For those employees who have no major physical defects, or handicaps, and who can be safely assigned to any type of work which the industry has to offer, a routine periodical examination is indicated. This examination should be thorough and include chest x-rays, urinalysis, and serology tests. It should be carried out on an annual basis and certainly not less than at two-year intervals. If performed less frequently, the primary purpose of the examination, that of early discovery of existing pathology or early recognition of potential functional disorders, is lost.

General Motors Medical Department

ANNUAL Meeting, July 29-August 2, 1946, Rochester, New York. Program:

Monday, July 29

CHAIRMAN—EDWIN J. NUGENT, M.D., Medical Director, Rochester Products Division, Rochester, New York.

ADDRESS of Welcome—MR. THOMAS L. LEE, General Manager, Rochester Products Division.

"The Necessity for Having a Definite Schedule for Periodic Re-examination of all Employees Including Salaried Group and Management Group"—C. L. SAMUELSON, M.D., Medical Director, Harrison Radiator Division, Lockport, New York.

"The Topical Use of Penicillin in Infectious Dermatoses"—FRANK F. FERLAINO, M.D., Medical Director, General Motors Corporation, New York City.

CHAIRMAN—BRUCE LARGE, M.D., Medical Director, Delco Appliance Division, Rochester.

ADDRESS of Welcome—MR. EDWARD A. HALBLEIB, General Manager, Delco Appliance Division.

"Trauma and Disease"—REEVE M. BROWN, M.D., Medical Director, Chevrolet Tonawanda Division, Tonawanda, New York.

"The Value of Plant Inspections when made by the Plant Physician with the Safety Director"—HUGH DIERKER, M.D., Medical Director, Southern California Plant, B.O.P. Assembly Division, Southgate, California.

"Wound Healing and Early Ambulation"—V. T. WILLIAMS, M.D., Medical Director, Fisher Body Division, Kansas City, Missouri.

ADDRESS of Welcome to University of Rochester School of Medicine—WILLIAM S. MCCANN, M.D., Dewey Professor of Medicine.

Presentation of Continuous Service Awards to WILLIS HUDSON, M.D. and MAHLON R. SUTTON, M.D.

"The Impact of Reconversion on The General Motors Health Maintenance Program"—C. D. SELBY, M.D., Chief Medical Consultant, General Motors Corporation, Detroit.

Tuesday, July 30

GENERAL Introduction — Medicine" — PROF. WILLIAM S. MCCANN.

"Non-bacterial Pneumonias"—J. T. SYVERTON, M.D.

"Epidemiology of Streptococcal Infections"—B. B. BREESE, M.D.

"Recent Advances in Diseases of the Liver"—J. D. GOLDSTEIN, M.D.

"Recent Advances in Hematology"—JOHN S. LAWRENCE, M.D.

"The Red Blood Cell as an Immunologic Tool"—LAWRENCE E. YOUNG, M.D.

"The Rh Factor"—DONALD KARIHER, M.D.

"Function of the Lung in Abnormal Circumstances"—NOLAN KALTREIDER, M.D.

Wednesday, July 31

TREATMENT of Hyperthyroidism" — L. A. KOHN, M.D.

"Some Clinical Considerations of Pituitary, Adrenal, and Gonad Inter-relationship"—E. HENRY KEUTMANN, M.D.

"Transperitoneal Lavage in Acute Uremia"—HERBERT R. BROWN, JR., M.D.

"Neurological Manifestations Following Accidental Electric Shock"—PAUL H. GARVEY, M.D.

"Dermatitis of the Hands"—HENRY C. SHAW, M.D.

"Tuberculosis Case Finding, Students"—GORDON M. MEADE, M.D.

"Tuberculosis in Industry"—ROGER ALLISON, M.D.

"Immunization in Tuberculosis"—RALPH JACOX, M.D.

Thursday, August 1

THE DIAGNOSIS of Neurosis"—PROF. JOHN ROMANO.

"General Introduction—Surgery: Problems Concerning the Sympathetic Nervous System"—W. J. MERLE SCOTT, M.D.

"The Problems of Cancer of the Breast"—SAMUEL J. STABINS, M.D.

"Experiences in the Secondary Closure of Wounds"—T. B. JONES, M.D.

"Struma Fibrosa and Struma Lymphomatosa in Chronic Thyroiditis"—JOHN A. SCHILLING, M.D.

"Cartilaginous Tumors of Bone"—GEORGE B. MIDER, M.D.

"Experimental and Clinical Experience with Cartilage Grafts"—FORREST YOUNG, M.D.

"Dysmenorrhea"—WESLEY T. POMMERENKE, M.D.

Friday, August 2

HEMATURIA"—W. W. SCOTT, M.D.

"Sprained Ankles"—LOUIS A. GOLDSTEIN, M.D.

"Progress of Investigation in Human Locomotion"—R. PLATO SCHWARTZ, M.D.

"Problems of Neurological Surgery"—W. P. VAN WAGENEN, M.D.

"Value of Intravenous Urography"—JOHN BENJAMIN, M.D., and VERNON L. BOLTON, M.D.

"General Introduction—Radiology: Myelography with Pantopaque"—PROF. GEORGE H. S. RAMSEY.

"Roentgen Therapy in the Painful Shoulder"—MURRAY P. GEORGE, M.D.

"Non-disabling Bronchiectasis" — THEODORE STEINHAUSEN, M.D.

GENERAL MOTORS MEDICAL CONFERENCE • ROCHESTER, NEW YORK • JULY 29-30-31, AUGUST 1-2
ROCHESTER PRODUCTS DIVISION • DELCO APPLIANCE DIVISION
UNIVERSITY OF ROCHESTER, SCHOOL OF MEDICINE

FIRST Row (Seated) Left to Right: P. B. RASTELLO, M.D., Ternstedt Manufacturing Division, Detroit; WILLIAM KRUGER, M.D., Chevrolet, Newark, New Jersey; L. J. BERG, M.D., Chevrolet, North Tarrytown, New York; WALTER F. HICKMAN, M.D., Chevrolet, Indianapolis, Indiana; A. A. TOWER, M.D., New Departure, Meriden, Connecticut; C. C. COADY, M.D., Buick-Oldsmobile, Pontiac, Kansas City; DENNIS J. FLYNN, M.D., Chevrolet-Buffalo, New York; REEVE M. BROWN, M.D., Chevrolet-Tonawanda, New York; M. R. SUTTON, M.D., Buick, Flint, Michigan; C. D. SELBY, M.D., General Motors Corporation, Detroit; MAJOR GENERAL WARREN F. DRAPER, U. S. Public Health Service, Washington, D. C.; A. H. SEIPLE, M.D., Packard Electric, Warren, Ohio; R. D. MUDD, M. D., Chevrolet, Saginaw, Michigan; EARL F. LUTZ, M.D., General Motors Corporation, Detroit; J. J. TYLER, M.D., Packard Electric, Warren, Ohio; CARL HANNA, M.D., Fisher Body, Baltimore, Maryland; O. HEYER, M.D., Fisher Body, Janesville, Wisconsin; E. W. SMITH, M.D., Aeroproducts, Dayton, Ohio; NEWTON E. LEYDA, M.D., Moraine Products, Dayton.

SECOND Row, Left to Right: HARRY MYRON, M.D., Brown-Lipe-Chapin, Syracuse, New York; T. M. THOMPSON, M.D., Fisher Body, Trenton, New Jersey; A. L. BROOKS, M.D., Fisher Body, Detroit; MELVIN L. HOLE, M.D., Saginaw Malleable Iron, Danville, Illinois; ROBERT MADDOX, M.D., Chevrolet, Norwood, Ohio; R. A. YOUNG, M.D., Buick-Oldsmobile-Pontiac, Linden, New Jersey; W.D. TILLSON, M.D., Electro-Motive, LaGrange, Illinois; CHARLES L. PARK, M.D., Fisher Body, Tarrytown, New York; J. E. MANNING, M.D., Saginaw Steering Gear, Saginaw, Michigan; FRANK R. FERLAINO, M.D., General Motors Corporation, New York; R. RUSH McADAM, M.D., Fisher Body, St. Louis, Missouri; W. L. BAUGHN, M.D., Guide Lamp, Anderson, Indiana; EDWIN DeJONGH, M.D., Detroit Diesel Engine, Detroit; HUGH DIERKER, M.D., Buick-Olds-Pontiac, South Gate, California; E. B. CUDNEY, M.D., Pontiac Motor, Pontiac, Michigan; W. C. GIBSON, M.D., GM Proving Ground, Milford, Michigan; GEORGE H. McDONALD, M.D., Chevrolet, St. Louis; RICHARD J. WEHS, M.D., E. I. DuPont; JOHN G. GANSCHOW, M.D., Chevrolet Gear & Axle, Detroit; HARRY M. JAMES, M.D., Delco Products, Dayton Ohio.

THIRD Row, Left to Right: V. T. WILLIAMS, M.D., Fisher Body, Kansas City, Missouri; E. A. IRVIN, M.D., Cadillac Motor, Detroit; J. S. LAMBIE, M.D., Fisher Body Division, Pontiac, Michigan; GEORGE A. PAUL, M.D., Hyatt Bearings, Harrison, New Jersey; WILLIAM J. FULTON, M.D., General Motors Corporation, Detroit; M. M. SHAFER, M.D., Frigidaire Division, Dayton, Ohio; R. L. JOHNSTON, M.D., Inland Manufacturing Company, Dayton; MARTIN I. HALL, M.D., New Departure, Bristol, Connecticut; RICHARD SWAN, M.D., Delco-Remy, Anderson, Indiana; G. A. EADIE, M.D., Detroit Transmission, Detroit; FREDERICK APFELBAUM, M.D., Hyatt Bearings, Plainfield, New Jersey; S. D. STEINER, M.D., Oldsmobile, Lansing, Michigan; O. J. PRESTON, M.D., Chevrolet, Flint, Michigan; B. T. ALM, M.D., Fisher Body, Detroit; RICHARD P. BELL, M.D., Cleveland Diesel Division, Cleveland, Ohio; EDWIN J. NUGENT, M.D., Rochester Products, Rochester, New York; C. A. LEATHERMAN, M.D., Delco-Remy, Muncie, Indiana; F. M. SHUSTER, DuPont Company, Chicago; FRED B. WISHARD, M.D., Delco-Remy, Anderson, Indiana.

That group, which is employed in spite of existing physical conditions or handicaps, requires much closer observation. This does not necessitate complete examinations but rather those of a specific nature. The hypertensives should have their blood pressure checked frequently. The diabetics should have urinalysis and blood sugar at specific intervals. The nephritics should have repeated urinalyses.

It is the duty of the industrial physician to predetermine the type and the interval of the special examinations at the time that he first becomes aware of the condition. From then on, the examination can be carried on by competent personnel. The clerical staff can call these people in to the hospital at a time when the work load is at a minimum, and the department can best spare the employee. A competent nurse can check the blood pressures and a technician perform the necessary laboratory determinations. It is only necessary for the industrial physician to see an individual when there has been some appreciable change in his status.

Equally as important as the physical examinations determined by the employee's physical condition are those which are performed on the basis of his occupational exposure. The employee may be on work which exposes him to the ordinary physical dangers of the operation. This danger may be great or small, vary from operation to operation and industry to industry. It will be influenced by the steps that have been taken toward accident prevention. The employees on such operations should be examined on the basis mentioned.

The employee may be on work which exposes him to toxic or irritating substances. This employee must have frequent examinations which may be of a very special type. But again the industrial physician can pre-determine the type and interval of the examination, and they will vary from time to time with the introduction of new substances. The personnel of his department can then assume a greater share of the work load. As examples: certain plating operations predispose to ulceration of the nasal septum; xylol and other benzine derivatives predispose to anemias; lead obviously predisposes to lead absorption and lead poisoning; foundry work predisposes to pulmonary pathology. There are many other instances where the exposure to certain materials or operations causes specific conditions. The effects of such exposures must be checked at scheduled intervals with examinations of a special nature which will show any effects of toxic exposure. While this might entail many examinations of a special nature, they can be carried out at scheduled intervals very efficiently. Competent nurses and technicians can perform the major part of the examinations and need refer the employee to the industrial physician only when the findings deviate from the normal.

AT HARRISON Radiator Division we have approximately 750 people who are exposed to lead on several different operations. Stipple cell counts are performed on all these employees semi-annually in the following manner. At a pre-determined time we are

furnished a list by the Records Section of all employees engaged in these operations, the department in which they work and how long they have been exposed. Our laboratory technician calls these people in and frequently goes to the department for the purpose of obtaining the blood smear. We recently checked 200 employees in a few days. The smears were obtained and the counts done by the laboratory technician.

Of the 200 smears taken, five showed stipple cell counts which were considered to be high. Of these five, we decided to recheck four in 30 days, while the fifth one was high enough to cause us some immediate concern. This employee was called into the medical department where he was further examined for evidences of lead absorption or poisoning. In other words, we performed 200 periodic examinations of a special nature at a pre-determined time, and it was only necessary for the industrial physician to be consulted in those five cases where the stipple cell count was high, and necessary for him to see only one employee.

The taking of chest films on our foundry workers is carried on much in the same manner at pre-determined intervals which vary somewhat according to the operation to which the employee is assigned. Again we are furnished a list by the Records Section of all the employees engaged in the operations with which we are concerned. The x-ray technician then calls the employee in and takes the chest film. When the films have all been taken, we have our roentgenologist interpret them. Knowing that the films which he is reading are on employees who have been exposed to operations which predispose to certain pulmonary pathology, he is in a much better position to furnish us with accurate interpretations of any findings.

Some industrial physicians may feel that these special examinations are not indicated in view of the precautions that have been taken in the factory to safeguard the employee. They may be content to feel that adequate ventilation will prevent the majority of occupational illnesses. I do not agree. In spite of all the precautions that are taken, we have no assurance that the employees will take advantage of them. We frequently see people carrying on their soldering operations outside the area of ventilation, stating that they can work faster if not limited in space. Another reason for not relying entirely on safety measures is that in the case of many new substances it is not as yet known what constitutes safe working conditions.

In performing specific examinations in this manner where much of the work is performed by the personnel of the department, the industrial physician must frequently check the work performed by them. The technician doing the blood counts and other laboratory work must frequently be checked to see that her solutions are fresh and her interpretations of the findings correct. The same is true of the nurses taking blood pressures and making other observations. Yet by performing these examinations of a special type and at scheduled intervals, the industrial physician can rest somewhat assured that he is fulfilling his duty as to protection of the employee's health and also checking on the industrial hygiene and toxicology.

The type of examination that I have mentioned pertains primarily to the hourly worker. Of course, the salaried employee having a physical condition or being exposed to toxic substances should have the same examinations at the same intervals that are set up for the hourly personnel. Much has been said and done for the protection of the hourly and salaried personnel engaged in general factory work. This no doubt arises from the passing of certain laws, compensation and otherwise, which have to deal with industrial safety, hygiene, toxicology, and the employees' working conditions. But in so doing, a grave injustice may have been done to those employees commonly referred to as the salaried group and particularly the management group. While these may not be exposed to the toxic substances and the physical dangers that the general factory employee is, this group hold positions in industry of such importance that we can no longer disregard their health and its effects on the operations of the organization. The replacement of a filing clerk who becomes ill might result in improper filing with loss of valuable records. The illness of a stenographer or secretary may delay the preparation of important records and documents necessary for the efficient administration of not only the department for which she works, but may influence the operation of the industry. As one goes up the level of responsibility and reaches the management group who carry a heavy administrative load, one must pay particular attention to their well-being. This is necessary for three reasons: the first is because of the importance of the positions they hold; the second is that their work load may be a predisposing factor to a general physical breakdown; and third, that people in this level have a sense of responsibility to the organization which sometimes causes them to continue working when physically they should not. By continuing to work they further endanger themselves. It would be better for them to take time off early when indicated. In many instances this might prevent more serious illnesses and greater loss of time, which is subsequently apt to occur.

In our own division we have had certain cases in the past year that have led me to believe that we are justified in setting up a definite program of examinations for the management and salaried group. I would like to call a few to your attention.

We had a salaried employee who was promoted rather rapidly. He adequately handled all promotions and finally reached the executive level. After spending about eight months in this capacity he suffered a complete nervous breakdown. This person is still on sick leave, and everyone concerned realizes full well that he will never return to his former position, and there is some question as to whether or not he can ever be absorbed back into the organization in any useful capacity. While it is now known that the basic reason for this condition was not related to his work, the unfortunate part about it is that on a review of the situation it was apparent to several people who were working with, and under, him that the symptoms had been present for some time. Had we had a definite program of periodic examinations for the executive group, this condition might have been recognized, and adequate steps taken to prevent the same by recommending that he have time off before he had a complete breakdown, giving him additional help or decreasing his work load, or by actually recommending a demotion to a lower level which he would well tolerate.

Another instance is a man in the executive group who reported to the medical department, stating that for some time he had had precordial pain upon exertion. He further stated that on a recent trip out of town, and we saw him the day after his return, it was necessary for him to stop several times coming up the stairs of the Grand Central Station because of paroxysms of precordial pain. This case was easily recognized as an angina of effort. We recommended a 60-day leave of absence, and management readily agreed. He consulted his attending physician, and on the 59th day of his 60-day leave of absence, while walk-

ing into his attending physician's office to see whether or not he should return to work, he suffered an acute posterior coronary occlusion, which necessitated additional time off. This man has been brought back to work at a markedly reduced level as far as his executive duties are concerned in order to decrease the emotional stresses and strains under which he has to work. Had he had a periodic examination at some definite time I am sure that we would have elicited the history of angina and would have been able to make certain recommendations which might have prevented the serious complications that arose.

Another instance was when one of our executives called and asked us if we would check one of his supervisors. He stated that this man had slowed down considerably in his work during the past year, and recently had a tendency to fall asleep during their departmental meetings. The individual cooperated wholeheartedly and reported to the medical department for an examination which revealed that he was a severe diabetic. We recommended a 30-day leave of absence, to which management agreed. The man consulted his attending physician, with the result that in 30 days he was on a well regulated diet, on proper dosage of insulin, and ready to return to work. We have checked on him on several occasions and he is now working as he used to prior to the symptoms previously described. Under a definite plan of periodic examinations this would have been discovered earlier, and it would not have been necessary for his superior to ask us to examine him.

In conclusion I would like to state that there is a need for re-examinations of all employees; that these should include examinations of a special type as well as those of a routine nature; that they must be carried out on a definite pre-determined schedule because only then can the program be properly administered by the industrial physician and serve its purpose; and that we must include the salaried, particularly the management, group in our industrial health program.

The Newer Uses of Topical Penicillin

—In the Treatment of Dermatologic Infections—

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THE TOPICAL use of penicillin ointments and solutions is becoming a regular standard procedure in industrial clinics. All therapeutic trials have demonstrated the effectiveness of this new antibiotic agent when it used locally in dermatologic infections. Many types of penicillin ointments are now available, made up with various forms of ointment bases. Many clinical therapeutic trials have been completed and many references have appeared in the literature during the past two years. All of these reports indicate that local penicillin therapy will be used in the treatment of certain specific skin conditions by industrial physicians, dermatologists and general practitioners.

While penicillin constitutes a significant contribution in the treatment of bacterial infections, it has specific indications and limitations. Its range of effectiveness in the bacterial diseases is greater than the sulfonamides, but penicillin is not a panacea and the hope that it would control all acute and chronic infections has been only partially fulfilled. The important bacteriologic studies disclose that the staphylococcus and gonococcus are both susceptible to penicillin whereas they are practically resistant to the sulfonamides.

The anhydrous ointment bases which are now being marketed retain their stability for nine months or longer when refrigerated. Their potency and stability represent an important achievement in the field of dermatologic therapy. The ointment, when applied locally, produces a high local concentration of the antibiotic agent at the site of infection. It spreads uniformly and liberates penicillin to the tissues in a most effective manner. The antiseptic action is exerted immediately and continuously as long as the ointment is applied. It is now generally recognized that penicillin not only exerts a bacteriostatic action but in many instances, a bactericidal action is exerted on the penicillin-sensitive micro-organisms. The present day ointment is also definitely superior to the earlier crude penicillin products and to penicillium-inoculated gauze which was reported to have effected satisfactory results in many of the pyodermas. These were used at a time when the present highly purified commercial product was not available for experimental purposes. The crude extracts[1] have been supplanted by the ointment or solutions of sodium or calcium salt of penicillin now that they have become generally available.

Penicillin is at present being incorporated in various ointment bases and these ointments are being widely used with successful results. Many confirmatory reports have appeared in the literature, indicating that penicillin creams and ointments are most effective in the treatment of a large number of dermatologic conditions. The powder of both the sodium and calcium salts of penicillin has not been used as it is irritating to the tissues. It has been combined with sulfanilamide or sulfathiazole, and, more recently, with dried blood plasma powder for experimental purposes. These combinations are, as yet, not available because of their uncertain stability. The ointments, however, appear to be most practical and convenient for topical application.

It was Fleming who first stated that penicillin used locally in more or less mild infections would prove extremely effective. Later Florey and Florey[2] used penicillin topically in several types of local infections. They first used it successfully in blepharitis and dacryocystitis. They also used it by injecting the solution into chronic wound infections and mastoid infections. They advised that in local therapy this new agent must be applied at frequent intervals and that treatment must be continued until all important clinical signs have cleared and until cultures become negative. These investigators stressed the fact that the action of penicillin on staphylococci and streptococci, unlike that of the sulfonamides, is influenced only to a minor degree by the number of organisms to be inhibited.

When used locally as an ointment, penicillin possesses three unusual qualities. It is effective in extremely high dilution, its toxicity is unusually low, and it is not inhibited by pus, tissue fluids, autolysates and the blood. It s superior to gramicidin and other known antibiotic agents against such organisms as: staphylococci, pneumococci, hemolytic streptococci, meningococci, gonococci, Treponema pallidum, Streptococcus viridans, Clostridium tetani, spirillum of Vincent. These organisms, are mostly gram-positive and are known as penicillin-sensitive bacteria. Whenever they are the infectious agents, excellent results have been obtained with the use of penicillin ointment. In other instances, a mixed bacterial flora, containing both penicillin sensitive and penicillin-resistive bacteria may be the cause of the infection. In these cases, penicillin ointment therapy may bring about a moderate improvement by eradicating penicillin-sensitive bacteria, but

it is not curative. No satisfactory method of treatment has as yet been found for mixed-bacteria infections. These infections are caused by a group of penicillin-resistant bacteria which are unaffected by the administration of this new agent. These are the gram-negative organisms represented by the colon-typhoid, dysentery group bacilli and by bacillus proteus and pyocyaneus, etc. There is hope that streptomycin may be the drug of choice when this new antibiotic agent becomes available.

Because of its well recognized bacteriostatic action on staphylococci and streptococci, penicillin is particularly well adapted to the treatment of diseases of the skin caused by penicillin-sensitive micro-organisms. It is evident that penicillin will ultimately replace other chemotherapeutic agents in the treatment of pyogenic infections of the skin.

For severe, deep-seated, acute or chronic infections of the skin, the combined route of therapy may be employed. Penicillin may be applied as an ointment to the infected area and parenteral therapy may be used. The usual intramuscular dosage is 15,000 to 25,000 units intramuscularly every three hours around the clock.

Penicillin Used Topically

DERMATOLOGIC CONDITIONS WHICH RESPOND TO THE USE OF PENICILLIN WHEN USED TOPICALLY: It has been definitely established that penicillin ointment is curative in many infectious dermatoses. To obtain favorable results, an accurate diagnosis should be established. In many instances, a bacteriologic diagnosis is essential. Whenever possible, it is always advisable to study the bacterial flora which are the cause of infection. This study will determine whether or not the organisms are sensitive or resistant to penicillin. Only in this way can a definite prognosis be given.

Local penicillin therapy can frequently be combined successfully in conjunction with systemic administration. Thus, the maximum concentration of the antibiotic agent can reach the infected areas.

The effective use of penicillin in infectious dermatoses and pyodermas has been established. Excellent results are obtained with this new antibiotic agent when local treatment is intelligently directed and properly supervised.

Sophian and Connolly[3] concluded that the local use of penicillin is a practical and effective form of therapy. In comparison with the difficult and more expensive parenteral administration, topical applications are preferable in dermatologic practice. Penicillin applied locally produces a higher penicillin concentration level than even the higher intramuscular or intravenous doses. Combined topical and parenteral routes are advisable when specific indications are present.

Penicillin ointments and solutions appear to have an unusually bright future because of their effectiveness in the treatment of cutaneous infections caused by penicillin-sensitive bacteria in dermatology. The present commercial calcium and sodium salts of penicillin have been incorporated in ointments, for use in the treatment of these conditions.

The treatment of acute superficial infections with this agent has given excellent results, for all the contaminating bacteria are reached by local application. When the infection is deep-seated and of long standing, and when there are areas of impaired vascularity, parenteral therapy as well as local therapy is needed. Before applying the ointment it is advisable to remove all crusts and dead tissue. Wherever pus is localized it should be evacuated surgically. Solutions or ointments must be applied in such a manner that a continuous state of concentration is maintained at the site of infected area. Penicillin is not a substitute for surgery when this is indicated.

The common organisms found to be the causative agent in these dermatologic infections are the Staphylococcus albus, Staphylococcus aureus, hemolytic streptococcus, non-hemolytic streptococcus and Streptococcus pyogenes. All these organisms respond to the action of penicillin. On a rare occasion a staphylococcus strain has been found to be resistant. Fortunately this is a more or less infrequent occurrence at present but it is expected that other resistant strains may make their appearance if inadequate and incomplete treatment is carried out.

Impetigo Contagiosa

EXCELLENT results have been obtained in impetigo contagiosa. Usually the ointment containing penicillin was applied two or three times daily. Cures were obtained in three to seven days. Many cases had resisted other forms of therapy.

This common pyogenic infection of the skin is usually caused by staphylococci and streptococci and, frequently, by mixed bacterial flora. In many cases, penicillin has proved curative within the first several days of treatment.

Twelve cases of impetigo contagiosa[4] were treated in which the crusts were removed before each application of sodium or calcium penicillin contained in Lanette wax combined with petroleum jelly. This ointment contained 400 units of penicillin per gram of bases. Eleven of the 12 patients were completely cured. The average period of time necessary to effect a favorable result was eight to nine days. Many of the individual lesions which were treated healed rapidly in a period of four days. Many of the cases were in a fairly advanced condition. It was thought that one application of ointment per day was as effective as two applications. It was advantageous to spread the ointment well beyond the infected area to prevent the development of additional new lesions. The bacteriologic finding in this group of cases showed that Staphylococcus aureus was the most frequent offender along with Streptococcus pyogenes. Cultures in one case showed staphylococcus and hemolytic streptococci, and in another case showed Staphylococcus aureus and diphtheroids.

Penicillin in the form of an aqueous solution[5] containing 200 units of penicillin per cc. is effective in the treatment of impetigo contagiosa, and also in the local treatment of other skin diseases caused by cocci. Taylor and Hughes stressed the fact that an adequate dose of penicillin from the start is essential to prevent the development of penicillin-fast organisms. They also used an ointment containing 200 or 400 units of penicillin per gram of Lanette wax base. It was noted that an underlying seborrheic condition in cases of impetigo contagiosa may cause a relapse soon after treatment is stopped. This necessitates an additional course of therapy. When penicillin-insensitive bacteria make their appearance, further treatment with penicillin is of no value.

Cohen and Pfaff[6] reported that a group of 11 severe cases of impetigo contagiosa did not respond to treatment with ammoniated mercury or sulfonamide ointments and that several of the patients had a secondary reaction to these drugs. The lesions were washed with hydrogen peroxide after decrustation. Penicillin ointment was then applied. In a number of patients the

infection was chronic and had existed from three weeks to three months. Penicillin ointment therapy resulted in clearing the infection in three to seven days. The authors said also that the use of penicillin ointment for the treatment of impetigo contagiosa is indicated when sensitivity to mercury or sulfonamide compounds exists and when the lesions are resistant to other forms of treatment. If a rapid cure is imperative, penicillin ointment is the drug of choice.

Gold[7] described a case of impetigo contagiosa which was successfully treated with sodium penicillin cream. The lesions showed typical raised yellow crusts and were diagnosed as impetigo contagiosa. Acriflavine and tannic acid were tried, as well as ammoniated mercury, but without success. Sodium penicillin cream therapy was instituted. The cream was made up of equal parts of lanolin, cod liver oil and water, and sufficient sodium penicillin was added to give a concentration of 500 units per gram. An application was made twice daily. There was a marked improvement on the second day of treatment, with a 50% reduction in the number of lesions. Further improvement was noted on the third day. Penicillin controlled the infection completely in a period of four days. A smear before penicillin therapy was begun showed streptococci, staphylococci, gram-negative cocci and bacilli.

Templeton and others[8] successfully used penicillin ointment containing 500 units per gram on six patients with impetigo contagiosa. All of the patients were cured within the short period of a week by using penicillin made up in a petroleum base.

With local therapy alone Cantor and others[9] obtained satisfactory results in 10 cases. The duration of treatment of these patients was from three weeks to three months. Staphylococcus aureus was the offending organism most frequently.

Sycosis Barbae (Vulgaris)

SYCOSIS barbae (vulgaris) is known as Barbers' itch. It is caused by the staphylococcus which attacks the bearded region. The upper lip near the nose is the commonest site. The advent of penicillin ointment has simplified the treatment of this frequently recurring condition. Both the ointment and wet dressings of penicillin in saline solution have given good results in a high percentage of cases.

If a fungus infection is suspected, bacteriologic diagnosis should be made since the fungus type of infection does not respond to penicillin.

Sophian and Connolly[3] incorporated penicillin in a suitable ointment base, using 1,000 units penicillin per gram. This was of striking value in acute chronic pyogenic infections of the skin and subcutaneous tissues and especially in sycosis barbae.

Several British investigators[5] have shown that penicillin is effective in the local treatment of skin diseases caused by cocci. According to these authorities, the most satisfactory method of treatment for sycosis barbae is to spray the lesion with the aqueous solution containing 200 units of penicillin per cc. Since this early report appeared, the ointment or cream has been found more satisfactory in the treatment of this common infection.

In another instance five patients[10] with sycosis vulgaris in which cultures showed the presence of Staphylococcus albus, Staphylococcus aureus, and diphtheroids were treated. Three of these cases responded favorably.

Other investigators[4] have stated that they treated 15 cases of this condition with satisfactory results. All of the patients were cured except one who failed to respond to treatment. There were some relapses. Five patients were completely cured and were observed for five months thereafter. Three patients were initially cured but suffered relapses after two to five weeks. These patients were cured. Five other patients of this group who suffered relapses were uncured. Most of these cases were of long duration. Ten of these cases had persisted from two to six years and had failed to respond to other forms of treatment, including the sulfonamides. The cultured organisms were Staphylococcus aureus and Streptococcus pyogenes. It was felt that in many instances penicillin ointment therapy was stopped too soon because of the scarcity of the drug. Continuous use of the ointment led to irritation in two cases. Because of the well known tendency of sycosis barbae to relapse, it was considered advisable to continue using penicillin prophylactically. These promising results have encouraged the authors to state that penicillin should be employed for the treatment of additional cases of sycosis barbae.

In another investigation Burrows[11] and his coworkers reported observations of 21 patients on whom they used penicillin cream. Bacteriologic examination showed that the organism was sensitive to penicillin. Of 13 cases with a history of more than one year, six were cleared in an average time of six weeks and six were improved in an average period during the same time. Of six cases with a history of less than one year, four were cleared in an average time of two and a half weeks and one was improving during a period of five weeks. No improvement occurred after the treatment of two cases due to insensitive strains of bacteria.

It is apparent that sycosis barbae shows a favorable response. Of 10 cases[9] six were markedly improved after a two-weeks' period, two were slightly improved, and two were unaffected. While penicillin wet dressings did not cure 100% of the cases, which had been treated for many months, all other forms of therapy did not give as good results as penicillin.

A number of patients were treated more recently with the new anhydrous fatty bases containing the calcium salt of penicillin in the concentration of 1,000 units of penicillin per gram of base. This treatment produced similar satisfactory results.

The occasional failure is caused by the fact that the causative staphylococcus may be resistant to penicillin. Careful bacteriologic studies and sensitivity tests will avoid this pitfall.

Infectious Eczematoid Dermatitis

JOHNSON[12] treated 15 patients with infectious dermatitis, of whom, three were hospitalized for parenteral therapy. Improvement resulted after the use of ointment; the lesions usually cleared in five days. The pustular scaly dermatitis resulted from staphylococcic invasion and sensitization. Four cases were superimposed on infantile eczema. Penicillin ointment also cured the infectious process.

Kierland[13] treated a series of 23 cases of eczematoid dermatitis with superimposed pyogenic infection. At first he used wet dressings and after exudation had subsided, he applied penicillin ointment. Of this group, five patients improved markedly and 15 showed moderate improvement; only two were unimproved, and one patient became worse.

Cohen and Pfaff[6] treated four patients with infectious eczematoid dermatitis; the ointment applied twice daily after the removal of crusts and detritus. They observed satisfactory results in three of these patients; one was unsatisfactory.

Carbuncles and Furuncles

BOILS AND furuncles are circumscribed staphylococcic abscesses which tend to suppurate. As a rule the lesions originate around a hair follicle. Boils may vary in size and they may recur over a long period of time.

Penicillin ointment containing the antibiotic agent in a concentration of 500 or 1,000 units per gram of base has proved to be a splendid local remedy. It is also of great value when used in combination with systemic penicillin or surgical treatment in severe or extensive infections of this type. It has been shown that in recurrent furuncles of the scalp or axillae, penicillin systemically and the ointment locally are of benefit in hastening recovery.

For example Sophian and Connolly[3] obtained satisfactory results in the treatment of furunculosis with a suitable ointment base containing penicillin in 1,000 units per gram of base. Roxburgh, and others[4] treated five patients with boils where Staphylococcus albus and aureus were the infecting organisms. Penicillin ointment was applied locally twice daily. In one case there was a rapid cure, while in the others, penicillin was of benefit in preventing the development of similar lesions. The authors point out that it is likely that penicillin solution may be of greater value and that further trials are necessary.

Penicillin ointment was employed by Cohen and Pfaff[6] on a patient with a carbuncle. The ointment was applied to the crater twice daily locally after incision and drainage. Their result was satisfactory; the base of the lesion presented clean, healthy, granulation tissue, and the rate of healing was rapid.

In the treatment of carbuncles, severe or recurrent boils, and rapidly spreading streptococcic infections, parenteral administration of penicillin together with topical therapy may be necessary to obtain the maximum effective results. Surgery should be employed as indicated.

Ecthyma

ECTHYMA is a deep seated infection of the lower extremities. This dermatosis has the appearance of a deep inflammation caused by pyogenic organisms.

According to Cantor and others,[9] most of the lesions are located on the lower extremities and vary in size from a five- to a 10-cent piece. There is oozing and the formation of crusts, which are best removed. Penicillin applied as a local wet dressing was effective in seven cases and rapid healing resulted. Patients treated with ointment also improved. The final results were satisfactory.

Ulcers of the Extremities

GOOD RESULTS have been obtained in 10 cases of varicose ulcer[14] by controlling the local infection with penicillin. Also, studies have shown that indolent ulcers improve rapidly when they are treated with local wet dressings containing 500 units of penicillin per cc. of saline solution. In several cases of post-traumatic leg ulcers, improvement has been obtained by the local application of penicillin ointment.

Tropical phagedenic ulcer (Aden or Malabar ulcer) is caused by fusiform bacilli and spirochetes. The lesion resembles oriental sore clinically and is extremely common in the tropics. The cause is unknown, although these same organisms are invariably present in pure culture during the active stage of the condition. Hamm and Quary[15] treated 18 patients and concluded that the local use of penicillin in the form of wet dressings is perhaps the most efficacious of all forms of therapy. The ulcers became clean quickly and this is most significant when it is realized that all the patients were natives with no idea of asepsis or cleanliness. Better results may be obtained with the use of intramuscular penicillin therapy when combined with this local form of therapy.

Skin Conditions Which Respond to Penicillin

THERE IS a group of conditions in which penicillin has given good results but the series of cases treated have not been sufficiently large to warrant conclusions. Morginson[16] obtained favorable results in treating a large group of skin diseases with penicillin. He had success in treating two cases of roentgen dermatitis, seven cases of secondarily infected lesions and a large number of Vincent's infection. Hellier and Hodgson[17] used penicillin spray most frequently, but they also used a penicillin emulsion containing 200 to 500 units per gram with 30% Lanette wax in water. According to their experience both methods were equally effective not only in the treatment of impetigo, ecthyma, and sycosis, but also in the treatment of the infective element in eczema and seborrheic dermatitis. Usually the lesions cleared in seven days. Used judiciously, penicillin can be of value in the treatment of infected eczema and seborrheic dermatitis but it is not curative. If improvement took place it was noted by the fourth or fifth day. The improvement resulted through the control of the associated infection.

Other dermatologic conditions caused by penicillin-sensitive micro-organisms which have responded readily to local treatment with penicillin ointment or solution are streptococcus and staphylococcus dermatitis, erysipelas, localized lymphangitis, corneal ulcers, otitis externa, blepharitis, dacryocystitis and Vincent's angina.

In this industrial clinic experience has shown that the topical use of penicillin ointment is of great value in the treatment of various types of infections of the skin. The ointment is usually applied three times daily in order to keep the antibiotic agent continuously applied to the infected area. The patient is advised to cover the lesion, whenever possible, with a protective ointment dressing so that the penicillin ointment will remain in contact with the lesion throughout the night.

There were three cases of impetigo contagiosa which had resisted all other forms of therapy. Improvement was noted in all of these three patients within three to five days after penicillin ointment therapy was instituted. The nightly application of penicillin ointment was continued for a short time thereafter in order to insure a permanent cure.

In two patients with sycosis barbae the topical use of this new antibiotic ointment brought about a satisfactory end result. This condition is prone to recur, but even after a prolonged period of observation both cases have remained cured. Because of the obstinate character of this condition treatment should be continued beyond the apparent immediate clinical cure to prevent its recurrence.

A series of five cases of early furunculosis all responded favorably to the application of penicillin ointment. Three cases with boils were greatly benefited by the local application of this ointment. Prompt early treatment is essential, otherwise they will follow a natural course. Not much change can be expected after the necrotic plug has appeared.

A group of three patients who were suffering with chronic infectious eczematoid dermatitis were studied. In each instance the condition had existed for many months or longer. Soon after penicillin ointment was

administered three times daily improvement was noted. Two of these dermatoses were cured; the condition of the other patient improvement but the dermatosis had a tendency to recur. When the ointment was employed locally in one case of ecthyma marked improvement was noted. Likewise two patients with infected ulcers of the lower extremities improved with the use of topical penicillin ointment therapy. Two patients with seborrheic dermatitis of long standing were markedly improved. In one patient the infective phase recurred but it cleared up once again with the use of the ointment. He prefers to use the ointment prophylactically to prevent recurrence of the infection.

Chronic blepharitis had been troublesome to three patients who had had the condition for many months. All three patients were greatly improved by the local use of penicillin ophthalmic ointment. Two of these patients were ultimately considered cured. One patient, in whom the condition improved, developed a local sensitivity with redness and swelling. This sensitivity reaction improved as soon as the ointment was discontinued.

In this small series of patients treated with penicillin ointment containing 1,000 units per gram of base there was no other evidence of local irritation, sensitivity or toxicity. The results obtained agree fully with the observations of many investigators. When correctly used in selected and accurately diagnosed cases, topical penicillin ointment therapy will become a valuable additional form of local therapy. Whenever patients have shown sensitivity to the sulfonamides or mercury compounds penicillin will be the drug of choice. As further experience is gained with topical penicillin therapy the list of skin diseases which have responded favorably to this new chemotherapeutic agent will be enlarged.

Methods of Application

VARIOUS METHODS FOR APPLICATION OF PENICILLIN IN DERMATOLOGIC INFECTIONS. In the treatment of diseases of the skin the topical form of therapy has been generally adopted. This form of treatment not only is convenient but it has been extremely effective. Ointments and creams have been used extensively. The concentration of penicillin most frequently used has been 500 to 1,000 units per gram of base.

Florey and Williams[18] have stated that penicillin may be applied locally in the form of solution, paste or powder. They believe that for favorable results the drugs must reach all of the infected areas and dead tissue must be eliminated, and that continuous administration of penicillin and direct contact application of the drug to all the infected regions requires ingenuity.

Various concentrations containing penicillin in physiologic saline solution have been applied locally in the form of wet compresses two to three times daily. This procedure has brought about effective results in the treatment of skin diseases, according to several investigators. A concentration of 250 units per cc. in isotonic salt solution has proved satisfactory, but in resistant or intense infections this concentration has been increased to 1,000 or more units in saline.

The dry powder of the sodium salt of penicillin has not been used widely because it is irritating to wounds and inflamed surfaces. However, in war wounds, a combination of penicillin powder and sulfanilamide or sulfathiazole has been employed with satisfactory results. Recently, reports have appeared that penicillin powder was combined with dried blood plasma for topical application. Cutler and Sandusky[19] have mixed sodium salt of penicillin under sterile conditions with dehydrated human plasma using from 10,000 to 20,000 units with 0.2 grams of plasma. Gentle stirring produced a light fluffy powder which can be distributed as a fine frosting on wounds or infected surfaces by means of a powder insufflator. When this powder is refrigerated it remains stable for 10 days.

SUMMARY OF VARIOUS METHODS OF TOPICAL APPLICATION OF PENICILLIN. Penicillin may be applied locally in several ways. The local application of penicillin is most suitable for the treatment of infections of the skin.

METHODS FOR LOCAL USE:

Creams or Ointments

Various bases are being employed at present in concentrations of 500 to 1,000 units per gram of base. The anhydrous ointment bases appear to be the most stable.

Saline Solutions as Wet Dressings

Continuous applications of wet compresses have been used with good results. The most commonly used concentration has been 250 to 1,000 units per cc. of physiologic salt solution. Concentrations may be varied to meet specific requirements. Applications of wet dressings may be made three or more times per day as indicated.

Local Infiltration of Penicillin Solution

This method has been recently employed with success in the treatment of carbuncles. Concentration of 25,000 to 50,000 units in saline solution is the recommended dosage.

Powder

Penicillin powder alone is not used because it is irritating. The drug has been combined with sulfanilamide or sulfathiazole powder. It is best to make this up fresh as needed. The duration of stability of these mixtures has not been ascertained.

COMBINED THERAPY

Fleming[20] has shown that 15,000 units injected every three hours around the clock is the minimum satisfactory dose to administer via the intramuscular route. In general practice, injections of 20,000 or 30,000 units every three hours night and day until cure is obtained are preferable. This form of therapy may be combined with local therapy consisting of ointment or solutions applied three or more times a day as indicated. Instead of intramuscular injection, penicillin tablets may be administered orally to produce a bacteriostatic blood concentration. It is well to remember that when it is given by mouth three to five times as much penicillin must be given to equal the injected dose. Oral tablets are being marketed at present. They contain either 20,000 or 25,000 units of penicillin with a buffer to prevent the destructive effects of the hydrochloric acid.

When penicillin is used locally as an ointment, an immediate extremely high concentration of the antibiotic agent can be provided at the site of infection. It has been estimated that the local concentration of the drug at the site of infection is much higher than the concentration that can be obtained by intramuscular or oral routes. This is especially true when concentrations of 1,000 to 5,000 units per gram of ointment are used. The multiplication phase of the contamination bacteria is thus rapidly halted.

The decision whether to use penicillin locally or systemically will depend on many factors: the nature, age, extent of the infection; the severity and chronicity of the disease; and the type of micro-organism causing the infection. The accessibility of infected areas to local

treatment is essential. In extensive, serious and severe infections both local and systemic therapy may be necessary.

The most important therapeutic principle to bear in mind when penicillin ointment or solution is used locally is to keep this new antibiotic drug in continuous contact with the infected areas in a bacteriostatic concentration for as long a period of time as is necessary to effect a permanent cure to avoid relapses. Because it is readily soluble and diffusable it can reach all the bacteria at the site of infection. Although penicillin possesses a high degree of diffusibility and is able to reach the more deeply imbedded organisms, continuous application must be maintained. The difficulty and expense of maintaining parenteral administration makes the topical use of penicillin preferable when it is practical and advantageous to use local ointment therapy.

It is well established that penicillin wet dressings are superior to other ordinary forms of wet dressings. Where the hemolytic staphylococcus and either Staphylococcus albus or aureus is the primary causative agent or the secondary invader, good results can be anticipated by the methods of therapy mentioned. Such results are obtainable in cases of impetigo contagiosa, ecthyma, and infectious eczematoid dermatitis. While results in some of the other skin diseases were less favorable, penicillin is still the superior antibiotic agent.

Penicillin Ointments

AT PRESENT, the most useful ointment bases contain a concentration of penicillin consisting of 500 to 1,000 units per gram of base. Many British physicians believe that Lanette wax bases are particularly stable and satisfactory for local therapy, but this base has not been available in the United States.

There are available, at present, penicillin ointments which have been made up with carbowax, aquaphor and other bases. The stability and potency of these have proved satisfactory. Aquaphor is a water in oil type of base which penetrates skin and allows slow release of the drug.

An ointment which remains stable for six months when refrigerated[21] and which may contain in the concentration of 500 to 1,000 units per gram of base the following ingredients: commercial petrolatum or hydrous wool fat, 25%; combined with cold cream, 75%. This showed satisfactory zone of diffusion.

Another satisfactory penicillin ointment[22] may be easily made in the following manner: Mix 100,000 units of penicillin in 2 cc. of mineral oil throughout. Mix this in 100 grams of anhydrous lanolin and petrolatum album each. The resultant ointment contains 1,000 units of penecillin per gram. It should be kept refrigerated. The following formula has been found to be very satisfactory: propylene glycol, 60 parts; carbowax, 40 parts. It can be made up to contain 500 to 1,000 units of penicillin per gram of base. The superiority of this ointment is based on the fact that it does not contain water and there is only 10% loss of potency over a period of several months.

Greey and Hebb[23] have devised this preparation: stearic acid (granular), 20.0 grams; Span 60 (Sorbitan monostearate),* 10.4 grams; Span 80 (Sorbitan monooleate),* 2.0. grams; Tween 20 (Polyoxyalkylene derivative of Sorbitan monolaurate),* 5.6 grams; water, 138.0 cc.

Careful studies of the stability and clinical usefulness of this preparation indicate that it is most acceptable as a cream base. It can also be easily compounded. It is not essential, but advisable to sterilize the base prior to incorporation of sterile penicillin solution.

One of the most stable commercial formulas for penicillin calcium ointment on the market is a fatty base made of beeswax, peanut oil, petrolatum, and anhydrous lanalin. In a fat soluble base which contains practically no water, penicillin is quite stable.

The stability and potency of penicillin ointments depend on the method of preparation as well as on the ingredients of the base.

Gots and Glazer[24] believed that the idea that penicillin in solutions and ointments deteriorated rapidly at refrigerator temperature should be abandoned, because they found that solutions and ointments kept at room and at incubator temperatures suffered no significant loss of activity.

Following these studies, pharmaceutical firms have spent much time and effort in improving the methods of production of stable penicillin ointment. In particular, the types of ointment bases have been improved. It is now known that any ointment bases containing water will not remain stable for a long period of time. Such ointments can be used only for prescription purposes during periods of a few weeks or two months from the date when they were produced. It is for this reason that anhydrous bases are being generally employed. These have been found so stable that according to the dates on the packages, commercial ointments may be kept nine months or longer.

Toxic Reactions

IT HAS been stated that penicillin is non-toxic. This statement may be applied to pure crystalline of penicillin but the present commercial products of sodium or calcium salts of penicillin may contain a certain percentage of impurities. The toxicity of penicillin when employed locally is extremely low.

Following the topical use of penicillin, toxic reactions occur in about two to four cases per hundred. Toxicity is most commonly manifested by exacerbation of the disease or by the development of a vesicular form of dermatitis in the area where the ointment was applied. Several instances of local irritations at the site of application have been reported. Among the other reports of allergy to penicillin is that of Keyes[21] who described a case of unusually severe allergic reaction to four drops of sodium penicillin, 1,000 units per cc., instilled into both eyes. The eyelids became red, hot, and nearly closed by edema. The author stated that allergy with urticaria manifestations had occurred. Additional reports of contact dermatitis have made their appearance.

Silvers[25] reported the case of a chemist working with penicillin who developed contact dermatitis. Patch tests showed that the patient reacted only to the impure sodium penicillin, whereas the pure white crystalline sodium penicillin caused no reaction in the skin. The author concluded that the contact dermatitis was caused by the impurities present.

In what is said to be the first case reported, Pyle and Rattner[26] described a case of dermatitis venenata from contact with penicillin on the face and genitalia of a medical officer in a military hospital. In addition, the authors stated that three hospital corpsmen, who had been handling penicillin, experienced slight discomfort and itching of the face and penis, although they showed no evidence of dermatitis. It was thought they suffered from a true allergic hypersensitivity or a chemical irritation. The medical officer who suf-

*Obtained from Atlas Powder Company, Wilmington, Delaware.

fered from the contact dermatitis showed a positive patch test with itching, erythema and vesiculation.

According to Gottschalk and Weiss,[27] penicillin when used locally is capable of producing contact reactions. Penicillin apparently is not a primary irritant in the concentration employed in these studies. By means of the patch test, they were able to produce epidermal sensitization to penicillin ointment in 4 to 5% of a group of 200 persons. It is thought that this is too small a survey to give an exact percentage of reactions to penicillin.

That sensitization can occur in tissues from the commercial ointments of penicillin currently being marketed has been demonstrated. In two cases of blepharitis treated favorably with penicillin ophthalmic ointment, an acute dermatitis developed. The use of ointment was stopped and these local reactions disappeared. But although transient urticaria, acute allergic phenomena, and contact dermatitis have been observed, the incidence is very low when one considers the large numbers of cases treated.

It has also been noted that sensitization and vesicular dermatitis have been noted more frequently when penicillin dermatologic ointment was used for the treatment of facial lesions than when used elsewhere. This may be due to the fact that more lesions of the face have been treated. Persons who have had epidermophytosis may be more sensitive to penicillin than other groups. A more recent report by Gordon[28] stated that toxic reactions result from penicillin rather than the so-called impurities.

Conclusion

THE TOPICAL use of penicillin ointment is becoming a standard form of therapy in industrial clinics. All clinical therapeutic trials of the past several years have demonstrated the effectiveness of this new antibiotic agent when incorporated in a suitable ointment base and used locally in the treatment of impetigo contagiosa, sycosis barbae, infectious eczematoid dermatitis, ecthyma, furunculosis, carbuncles, chronic ulcers of the extremities, and other susceptible infections of the skin. The treatment of staphylococcic and streptococcic local infections of the skin has produced the most dramatic results. It has proved to be of value in the treatment of secondarily infected lesions, which are superimposed on dermatophytosis, acne vulgaris and contact dermatitis.

Penicillin is not a cure-all for skin infections. It will not replace accurate diagnosis and other specific therapy, nor will it replace surgery and debridement. But when used locally penicillin is an ideal antiseptic. It inhibits the multiplication of penicillin-sensitive bacteria in extremely high dilution. It has a very low toxicity. Its action is not impaired by pus, blood serum or tissue autolysates. On the whole the clinical results which have been obtained by the use of penicillin in the treatment of certain dermatologic infections, have been striking and favorable.

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Trauma and Disease

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WHEN ASKED to present a paper on Trauma and Disease I could not but rationalize my own many shortcomings on this subject. The etiological relationship between trauma and disease is not covered by exhaustive literature. Too much attention has been directed toward the medicolegal phases rather than to clinical, laboratory and pathological manifestations and correlations of positive findings. Often medical textbooks list trauma among the etiological factors in many diseases but fail to give facts regarding this correlation from which the physician can draw his own conclusions.

While searching for information to determine specific etiological considerations I came across an interesting textbook on pathology which goes a long way to clarify the relationship of trauma and disease. This text was written by Wiley D. Forbus under the title Reaction to Injury and gives such a ideal presentation I am forced to follow the author's conclusions vry closely. This work approaches the subject from a pathological point of view.

It is pointed out that "disease" is a "departure from a state of health" and is derived from the French, "*des*," meaning "negative," plus "*aise*," meaning "ease." It is a definite morbid process having a characteristic train of symptoms and may affect the body as a whole or any of its parts. "Trauma" is a wound or injury derived through the Latin from the Greek τραῦμα meaning "wound" or "blow," the intent of which is to denote that some form of violence or impact has occurred

which produces either a bruise or a cut of the parts involved. As Morehead has pointed out, "Trauma is that which produces either a contusion or a laceration and when we reduce all forms of trauma to this basis, we find that we have the foundation of the entire subject reduced to simple terms. Viewed thus we modify and limit our conception of trauma and bring it into line with a pathologic concept that denotes the structural changes which transmute themselves into effects which register as symptoms." Trauma differs from any other pathological process in many respects, among which may be listed the following: there is no period of incubation; it is inescapable; there is no respect for age, race, sex, social position, or season; it is endemic and epidemic.

"Injury" is derived from the Latin, "*in*," meaning "not," plus "*jus*," meaning "right." However, in relation to disease injury indicates a process, or, as Forbus states, the term injury "will always mean the occurrence of an event and not simply the state of affairs existing at the moment the happening ceases."

Thus, it would appear that trauma is that which may cause an injury; whereas disease in all of its forms may be looked upon as a "reaction to injury." Forbus further qualifies reaction by stating "cells and the body as a whole may be considered capable of responding to injury in three essential ways, as follows: by passive submission; by offering combat or active resistance; by effecting an adaptation to the changed conditions and circumstances arising in the course of injury." Acute disease follows sudden and intense reactions; chronic disease, when the reactions are mild, are slow to develop or of prolonged duration. Also disease may be local or general dependent on the degree and character of injury, the quantity of tissue injured and the reaction provoked.

To comprehend the reaction to injury one must begin with an individual cell of the human organism. To understand clearly the cellular reaction we have a chart which shows the cell with its immediate and surrounding environment so that we can more purposefully study the forces acting upon the cell.

This chart is a schematic arrangement depicting man as a cell surrounded by his internal environment and separated from the unlimited external environment by a living zone of exchange. Within the inner dark circle will be found the ultimate factor which determines the balance between the individual and the outer environment. There will be found the individual's constitutional make-up as determined by the chromosomal and cytoplasmic arrangement within the cell. Immediately beyond the dark line limiting the cell itself will be found five zones representing functions performed by the cell in its internal environment, namely: protection, nutrition, regulation, excretion and gaseous exchange. These functions are limited by the layer demonstrated as endothelium. It is between these layers of endothelium that the body fluids circulate and continuously perform the five important functions of the cell. The materials found within these endothelial limits are the body fluids containing the chemical make-up of the individual and may be known as the internal environmental factors. As will be observed, the endothelium of the outer layer is used for transport and protection. Beyond the endothelium is the mesothelium. The mesothelial layer gives support, exchange and protection to the cells. The extreme outer circle of epithelium gives protection and exchange. This constitutes the outer limit of the internal environment. We now enter that portion of environment which may be called the external environment. It is roughly divided into three classifications: the animate external environment, the inanimate elementary chemical external environment, and lastly the inanimate complex physical chemical external environment. Although we are all conscious of the animate external environment we pay little heed to its presence until the conflict between this environment and the cell of the man becomes so furious as to represent a serious threat of invasion by individuals of that vast animal and plant kingdom.

Trauma is related to that scheme of inanimate complex physical chemical environmental agents noted on the left hand side of the chart. These include invisible radiant energy, water, light, cold, heat, physical mass action, atmospheric pressure and chemical energy. If trauma alone were the only consideration, we would interest ourselves only with this section. However, because of the ever present animate external agents in the environment of the individual, the entrance of these factors cannot be neglected.

In spite of the almost unlimited changes in the external environment of man, particular response is to a large degree limited. The intrinsic environment of the individual plays a tremendous part in the response possible under certain stimulations. Trauma producing sudden or pronounced injury is most usually followed by the reaction of submission, as, for example, partial or complete loss of function, loss of substance, either actual or through the process of atrophy following an interference with the blood supply. If the injury following the trauma is severe, death may occur. When mucous membranes are subjected to stimulation by strong chemicals, a combative type of reaction occurs, such as the excessive production of mucus by the lining cells of the gastro-intestinal tract or by the formation of antibodies in certain bacterial and viral infections. Inflammation, which is the commonest specific reaction to disease, represents clinically the best example of the combative type.

The individual and his cells and their combination readily become adaptable to a multiplicity of changes. A good example may be found in the changes of the mucosa of the gall bladder where the high columnar epithelium becomes transformed into stratified squamus epithelium when subjected to the irritation of gall stones. The removal of certain food factors from the diet may result in a complete change in the morphology and function of the pancreatic and other secretory glands.

Therefore, in the study of relationship of trauma to disease, it is essential to consider the factors involved, namely: the intrinsic etiological factors which lie within the body, chemical and functional; and those extrinsic etiological factors without the body which are seen in that huge area lying outside the individual.

Trauma, defined above as a blow which produces contact between physical masses and part of the body is the simplest and oldest form. The effects of trauma will partake of the nature of the mass. These effects are classified as those due to solids, those due to liquids, and those due to gases. In general, the effects of physical mass action will vary with the size, shape and movement of the mass. Also to be considered is the distance and the time and the frequency with which the mass contacts the living structure. The effect of liquid masses on living tissue is directly related to its temperature, specific gravity, volume, speed, viscosity and chemical action if any is present. The effect of gases is in direct relationship to the concentration and the force with which it is applied, but more importantly upon the chemical structure of the gas.

PHYSICAL mass action may result in contusions or bruises which follow, more or less, sudden blows causing rupture of the blood vessel with the escape of blood into the potential tissue spaces by the mechanical displacement and actual crushing or tearing of the cells and interstitial spaces. These lesions cause local disturbances usually associated with pain, swelling and induration. Frequently, changes follow which are characterized by color as the extravasated blood disintegrates liberating blood pigments. There is a definite relation between a given type of trauma and the tissue composition in the area affected, the more elastic, pliable tissues being less damaged than the more resistant ones. Even deep lying internal organs may suffer in the absence of surface injuries. Insignificant injuries of the head producing little or no superficial evidence in the scalp may cause pronounced brain injury with the characteristic laceration of cortical tissues and complete loss of consciousness. (This is not infrequently found in contrecoup.)

Lacerations may be considered as contusions made with a sharp instrument. The degree of sharpness of the instrument may be observed in the effect it has on the tissue. Maceration and tearing will result from lacerations due to dull instruments which separate the tissue, opening many blood channels but without great loss of blood.

Injuries of a compression type may be due to considerable force applied to the body under slowly applied pressure and will vary with the degree and suddenness of application. This type of force is either fatal to the local tissues or may be fatal to the structure or body as a whole owing to the collapse of the vascular and lymphatic channels or the mechanical action of temporary ligation. The continued pressure may result in nerve block with interference of normal metabolic activity, resulting in atrophy of the part. There exists a definite relationship between the amount of external pressure and the normal tension of the body and tissue fluid. Constantly applied pressure interferes with the nutrition of the compressed parts, leading to eventual death and disintegration, with the formation of an ulcer. The results of this type of injury may also be found when large quantities of fluid escape into contained spaces where inelastic outer structures cause pressure against the less elastic viscera. This is especially true in the brain. Stretching or distension which is the opposite of compression has the same effect on tissue.

Mechanical principles hold that tissues influenced by external forces undergo a transformation dependent upon the nature of the force and upon the elasticity of the tissues. Tissues so exposed to external forces may be compressed, sheared, extended, bent or twisted, with rearrangement or disarrangement of the units.

Influence of trauma on these structures will vary with the nature and direction of the force and may lead to fracture of bone or rupture of tissues composing internal organs. The injury to internal organs usually is the tearing of the capsule or fibrous covering with or without extension deep into the underlying tissues with the opening of vessels, ducts, and lymph channels or even the hollow lumen of the organs.

The effects of trauma may be local or systemic injury usually affecting the vascular and nervous systems. Local injury is followed by pathological alteration in structure and function, the intent of which is repair of the damage. Blood vessel damage may result in loss of blood supply not only to the local area and the neighboring tissues with the development of extensive necrosis but also by the phenomena of thrombosis or secondary emboli eventually leading to embolism in some remote part, as the extremities or pulmonary or cerebral areas. Foreign material, such as air, gas or fat from bone marrow, may enter a torn vessel with the serious consequences of capillary obstruction. The formation of arterial venous aneurysm with resulting disabling changes in the general circulation may be produced as a result of injury to large arteries and veins which lie proximate to each other. Internal bleeding with dissection of loosely constructed tissues may lead to compression injury, and, when in vital areas, leads to death.

Local injury to the nervous system may only be stimulation of the pain perception fibers but may be more general as found in certain pyschic disturbances. It may be considered shock concussion and may lead to the development of traumatic neurosis.

The effects of physical mass action on tissue may also lead to the introduction within the body of bacterial infection. As observed in our chart, bacteria are found in the animate external environment of the individual and when given entrance through injury, especially when tissue has been lacerated or devitalized with the presence of hemorrhage, optimum conditions for their growth and proliferation are present.

Again, a look at our chart shows the presence of another large group of factors in the inanimate elementary chemical external environment which must be considered in relation to injury, especially those due to external trauma. These chemical agents, singly or in combination, are used as therapeutic agents in the treatment of injury. Also must be considered certain of the animate external environmental factors which today are finding more and more use in the treatment of wounds.

Critical discussion of the influence of trauma on certain pre-existing conditions or conditions which may arise directly or indirectly as a result of the trauma must be presented by those interested in such studies.

The results of healing of injuries must be considered as it effects the individual or part. The trauma, when injury is the result, may be relatively small with only minor destruction associated with temporary loss of function. Excessive scarring or callus formation may injure nearby vascular or nerve tissue with results entirely out of proportion to the amount of damage suffered at the original site of injury. The reaction of the individual to mechanical trauma may equal or exceed the original destructive injury.

TRAUMA produced by electric currents must be discussed separately because the effect of electric current on an individual depends on several factors: the type of current, the voltage, the amperage, the nature of the contact, the length of contact, and the pathway of the current.

There are two types of current which are of importance, the direct and the alternating, of which the latter is the most dangerous. The 110 to 120 volt current used in most homes in this country falls within the very dangerous range of 39 to 150 volts of alternating current. It has been stated that low frequency currents are dangerous and those of high frequency harmless. Human muscle and nerve are insensible to frequencies of 400,000 and upward. Usual domestic and industrial currents are in the low frequency bracket ranging around 60 cycles per second. Frequency as high as 400,000 to 1,000,000 cycles can be borne without injury. Direct current of 200 to 250 milliamperes and alternating currents of 70 to 80 milli-

amperes are usually dangerous for normal individuals. Higher amperage may prove fatal. The effects of ordinary voltage of 110 depends upon the amount of resistance offered by all of the tissues but especially by that of the skin. When the skin resistance is around 1,200 ohms as found when the skin is wet, the ordinary 110 volt current may prove fatal since approximately 90 milliamperes pass through the body. The condition of the contact with especial reference to the grounding is very important. The better the ground the more readily the current passes through the body. Also, the larger the contact, the more serious may be the effect, the larger contact permitting the greater amount of current to enter the body. Secure and close contacts tend to lessen resistance. The increased amount of moisture, as perspiration or water on the surface of the skin, increases the dangers through lowering the resistance to the passage of the current. The length of time the contact continues will determine the quantity of current that passes. An accidental contact with a live wire by a hand with the resultant tetanic contraction may thus improve the contact and facilitate the passage of current over a longer period of time. The pathway that the current takes through the body to a very large extent determines the effect of the electric trauma. Usually only a limited area or even point on the skin represents the port of entry. The current then disperses, travelling in a radial direction to finally converge again at a point of exit, usually the grounded area. If the passage through the body traverses a vital organ, the results are apt to be fatal. Skin possesses a very high resistance of about 40,000 ohms per square centimeter. Jellinek has pointed out that blood is the best conductor and with the vessel walls provides passage for most of the current. The internal organs with their mucous membranes are excellent conductors.

High frequency alternating currents of different varieties produce their effect through the generation of heat and vary with the character of the current. In diathermy only a moderate rise in the temperature of the field appears without permanent injury to the tissue. Systematic temperature may be elevated through the distribution of heat throughout the body by the circulating blood and tissue fluid. Other high frequency currents are capable of destroying tissue as in surgery with the electric knife. On these principles are based the adaptation of fulguration, desiccation, and coagulation. Direct currents produce heat but it is believed other effects are produced through electrolytic processes accompanied by the liberation of gases and significant changes in the hydrogen ion concentration of the tissues. The make and break of direct currents are so shocking by the suddenness of injury that even death of the tissue may occur. The points of entry and exit of high voltage current produce a vasomotor phenomenon not a burn, or by contact the skin may suffer a burn without actual destruction of tissue. However, in the end the tissue usually dies. Still another type will be characterized by maceration and tearing of the tissues. Destruction will vary greatly, both as to distribution and depth. Electric burns produce definite histological changes of alteration in the structure and shape of cells. It is interesting to note that electric burns differ from ordinary burns by their failure to show inflammatory reaction without hyperemia and pain, and the absence of suppuration. Although the local injury may have serious consequences, trauma of electric current produces most profound effects upon the nervous system. Pronounced alteration of the structure of the cells of the brain can be demonstrated. Hemorrhages may be seen throughout the central nervous system. Striated muscles are found to have functional and structural changes following the violent tetanic contraction which not infrequently may cause rupture of muscle or even fracture of bone. Smooth muscle suffers in similar manner without structural change. So too are the changes found in heart muscles. In electric traumatic injuries the bones, blood vessels, and the blood itself, also the eyes, sustain severe injury. Loss of accommodation and the formation of cataracts may occur as late manifestations. Severe injury to the kidney in some cases is demonstrated by albuminuria and hemoglobinuria. It is believed that death is due to injury of the respiratory center resulting in paralysis of the respiratory movements. Rigor mortis is very marked.

THE TRAUMA produced by heat or its relative absence is an important factor in disease production, since the normal functions of living tissue are continually associated with both heat production and heat absorption. Hence, heat is both an agent capable of producing injury and at the same time is an environmental factor influencing the development of disease processes entirely unassociated with heat. Normal body temperature may represent the balance between the chemical and physiological heat production of metabolic processes going on within the individual and is dependent upon the activity and the diet on the one hand and dissipation of heat through radiation, convection, conduction, evaporation of water changing the temperature of inspired air to that of the body, liberation of carbon dioxide loss through excretions on the other. Reference should be made to Best and Taylor for a thorough understanding of the complex mechanism involved in heat regulation in order to understand how the temperature of an individual will remain constant in spite of the extreme variation to which he is exposed. Interference with heat radiation, convection or conduction and with evaporation from sweat may result in temporary rise in body temperature. Heat loss greatly depends upon the degree of atmospheric humidity. Alteration of the balance between heat production and heat loss causes changes in body temperature. Human tissues die when heated to 50° centigrade, macrocytic activity and mobility of leucocytes cease at 40°, red blood cells hemolize at 60° and cell proteins coagulate at 70°. Combustion of all of the components of tissue produces dehydration. The low limits are unknown. Temperatures below 30° centigrade depress the respiratory and cardiac rates with diminution of metabolic activity and depression of the cortical centers. Tissues may actually freeze with the withdrawal of water and its crystallization in the interstitial spaces.

HEAT stroke and sunstroke may be cited as examples of tissue injury due to excessive exposure to heat; however, in the latter it is believed light rays from the sun exert an effect upon the tissues especially of the brain independent of those produced by heat waves. Changes in the concentration of the blood and tissue fluid electrolytes are of considerable importance when the salt and water balances have been restored. The automatic change in temperature of the individual as the result of intoxication or dehydration of tissue, and in disease, when within limits may be advantageous; however, if they reach the higher limits may become as dangerous as those of sun or heat stroke. The use of artificial hyperpyrexia in the treatment of

certain infectious diseases has gained considerable prominence. These artificial fevers may produce the same effect as heat or sun stroke.

BURNS result as the local application of heat and vary with the intensity of the heat and the duration of the exposure. Various classifications for the intensity of burns have been introduced but the most usually and widely used today is that classification which refers to three degrees, the first being an erythema of the skin as the result of dilatation of blood vessels and hyperemia with the signs of mild acute inflammation. Burns of second degree have a greater physiological response characterized by dehydration of the cells and tissues and formation of blisters. Marked inflammatory reaction follows. In third degree burns there is marked destruction of skin with cell death, coagulation of tissue protein and the blood in the nearby vessels with severe dehydration. Healing, if it occurs, produces a thick dense scar with little or no regeneration of the damaged tissue. Superficial and relatively small burns have been known to lead to death for which there seems to be no explanation. Abnormal protein constituents in the blood suggesting a protein intoxication indicates the complexity of the multiple physiological disturbances. Secondary infectious processes are not uncommon. Functional disturbances, the result of formation and subsequent retraction of scar tissue are frequent. Disfiguring scars, especially in the face, produce further disability. Not unlike the effect of heat, cold produces response in the tissue as a primary vasoconstriction, secondary vasodilatation followed by collapse of the vasomotor control. Spastic contraction of blood vessels produces serious interference with the nutrition of the tissue.

THE EFFECTS of light or radiant energy will depend upon the source and the type of waves emitted from any given source. The stimulating and lethal effects are too complicated to be considered here.

THERE ARE two conditions of importance related to atmospheric pressure injury; namely, those of low atmospheric pressure as found in mountain sickness and those associated with high atmospheric pressure as found in caisson disease. From an industrial point of view greater significance is placed upon the effects of high atmospheric pressure. Workers exposed to high atmospheric pressure in caisson and underwater construction are subjected to the influence of oxygen pressure with diminished availability of oxygen for body tissue and the physical solution of the absorbed atmospheric nitrogen into the blood tissue and tissue spaces. The supersaturation of the blood by atmospheric nitrogen depends upon the degree of pressure, the length of exposure and the ability of tissues to absorb the gas. Nitrogen absorption is not harmful; however, injury occurs when the pressure is reduced and the free nitrogen is liberated from the supersaturated blood. By the gradual decompression the liberated gas is eliminated from the lungs. The signs and symptoms often referred to by the workers as the "bends" occurring from a few minutes to several hours following improper decompression are due to the presence of free nitrogen gas bubbles in the circulation which interferes with the proper conveyance of oxygen to the tissues and also by pressure produced by accumulation of gas in tissue fluids and joints.

CHEMICAL substances are almost limitless. For specific action, reference should be made to modern texts and journals on the subject of toxicology.

THE OBJECTIVE of this paper was an attempt to evaluate the etiological factors resulting in injury. Obviously one can encounter considerable difficulty distinguishing between the effects of trauma and of disease not produced by trauma. In order to evaluate the pathological response to trauma one must begin with the initial effect—injury and its potentialities. In other words, if we consider an individual cell exposed to an agent capable of producing trauma, bearing in mind the etiological factors discussed in this paper, with the pathological picture presented, we will begin to understand the relationship of trauma to disease.

The Value of Plant Inspections when Made by the Plant Physician With the Safety Director

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THE subject I am about to discuss has interested me for some time. It deals with the integration of plant medical and safety programs.

As a member of the General Motors Corporation group I realize that we are members of a team. However, since my war experience was that of a consultant to many organizations in the southwest coast areas, with many administrative and personnel details with which to contend, I would like to point up the essentiality of close working relationships with the safety engineer.

Let us review, in brief, the several functions of the medical department and evaluate in which respects medical and safety departments enter into synergism.

We are, of course, fully aware of our joint objective of prevention. Also in the matter of records there is a joint responsibility. It was amazing, and somewhat disconcerting to me to see the apparent antagonism between medical and safety departments in a number of key plants. Further thought and study revealed the fact that, as with so many administrative problems, the conflict arose out of the press of work, with consequent lack of time to "get together" and review mutual interests. Once this point was brought home, the interested parties did get together and real progress was made when they each understood that the others' work was toward the same end.

As we all know, there is no time for strict specialists in competitive enterprise in so far as the working team is concerned. We must all know enough of the details of the other fellows' work to appreciate the problems of the production line, maintenance, cost accounting, human engineering from the labor relations and safety angles to fit ourselves into the productive pattern.

Enough of generalities. To be specific, our over-all policy falls within the area of general thinking in so far as the legal responsibilities and humanitarian aspects of industrial medicine are concerned:

Care of Occupationally Incurred Illnesses and Injuries

IT IS a fact that 10% of the working population accounts for 90% of the injuries in any given plant; but how is the safety director to recognize these people if we don't warn him of them? Furthermore, if the safety director is not given a true estimate of time loss, how is he going to develop his records? It is the duty of the medical department to elicit a good history of the

mode of injury in all its important details of time, place, contributing factors, etc., so that the safety engineer will have the proper information to use in preventing recurrences.

Prevention of Occupational Illnesses and Injuries

THE PREVENTION of occupational injuries is primarily the job of the safety engineer. However, from the educational standpoint, the medical department can aid the safety program. Education is most effective when personalized. A man will readily heed advice regarding safety goggles when he is being treated for the removal of a foreign body from his eye.

On the other hand, occupational diseases are almost entirely preventable. According to the National Association of Manufacturers, 67% of occupational diseases are prevented when good medical and safety programs are instituted. The bulk of the remaining 33% of occupational diseases are no doubt due to hypersensitivity of the skin. In the prevention of occupational diseases the safety department, the medical department, plant engineering, and process engineering must work as a team. The doctor may detect early signs and symptoms of poisoning in workers on a given process. He may give recommendations for control on a physiologic basis, such as rotation of workers. But this alone is not enough. The safety department is also vitally interested in preventing such occurrences. However, guards and rails will not control the situation because toxic agents do not recognize these barriers.

There are three portals of entry to the body for toxic agents. The skin is a negligible portal except for some few materials such as tetraethyl lead. The gastrointestinal tract is important only where dosage is so large as to constitute gross negligence. But the respiratory tract absorbs materials in a disconcertingly efficient manner.

Since the basic method for control of toxic exposures is the substitution of non-toxic or less toxic materials in an operation, we must work closely with process engineering and the chemical department to accomplish our end. Process engineering can advise on materials which will do the job, and the medical director can advise regarding the toxicity of materials. The control methods of general ventilation, local exhaust ventilation, and isolation of processes are properly within the province of plant engineering for installation. However, control methods such as these must be constantly checked to insure continuity of efficient control. Air samples may be taken in the breathing zone of the workers, and it is most useful to do frequent ventilation studies on local exhaust systems. If the exhaust system is so efficient as to preclude the possibility of toxic agents reaching the breathing zone of the worker, then fewer air samples need be taken. In such a program of samples and ventilation studies, the medical and safety directors can instruct the safety inspectors in such fashion that they can do a good job for routine work. The doctor's professional talents are more than fully occupied in treatments, general health supervision, pre-placement examinations, etc. But with the aid of the safety inspector trained in this work the safety director and medical director can adequately keep an eye on control procedure by joint periodic checks in the plant.

The last control method to which we turn is the use of personal protective equipment. Because of the difficulty in getting men to wear respirators owing to the discomfort, such equipment should be the last control measure to be considered for any long time exposure. Of course for short operations, where the expenditure for ventilating equipment would not be economically sound, respirators may be the solution to the problem. Here again the joint operations of the medical and safety departments are of value not only in procuring the proper type of equipment for the men but also in cooperating with the foreman in seeing that they are properly fitted, sanitized and worn.

In the instance of the most common occupational disease—the occupational dermatoses—the combined operation of medical and safety departments with the foreman is essential. The materials which cause dermatoses should be catalogued, and individuals sensitive to any of them should have their occupation changed. However, the great bulk of dermatoses can be controlled by a common sense approach. The medical department should give detailed instructions to the men as to proper washing techniques and the changing of work clothes and may recommend protective ointments or protective clothing. The safety director should see that the men are furnished with the appropriate materials and that these are properly handled and maintained. Here again inspections of the plant with the safety director help to maintain the proper control.

Placement Program

IN THIS work the principle is to place the right man on the right job in so far as his physical capacity is concerned. Going back to prevention again, the safe worker is usually a good worker. In any analysis of physical placement, the safety factor must be a major factor for consideration. The safety director, with his wealth of experience in this phase of the program, is a key person. By making joint plant inspections of the various jobs, it may be found that a man working in assembly may have the physical capacity to push so many pounds so many hours per day but because of his height he is unable to do the job safely. He may, because he is too tall, have to stick his leg out so far to balance himself that he is subject to a serious hazard from passing equipment.

In the placement of handicapped veterans, the safety director is certainly indispensable. In such cases the safety director, the employment manager and the medical director should get together with the man after his physical capacity is analyzed. Then the man should be placed on a job where his talents are best utilized to his own and the company's advantage, *without further jeopardizing his physical status.* It is, of course, obvious that a one-eyed man must not be placed on a job in which there is any hazard to the remaining eye. And we cannot rely on the handicapped veteran to protect himself. He almost invariably feels that because he can see perfectly well he is as good as the next man. This is true, but he has no margin for error. Therefore, the periodic checks by the medical and safety directors, plus the continuous checks by the safety inspectors lead to good control of the activities of such individuals.

Supervision of Plant Sanitation

THERE ARE certain basic legal requirements imposed by the health and labor departments concerning the sanitation of plant cafeterias, water supplies, sewage disposal systems, rest room facilities, and showers. It is usually the responsibility of the plant medical and safety departments to supervise the general sanitation program. Whenever an inspector of the health department or labor department visits the plant he should be referred to the medical and safety departments, the directors of which accompany the inspector on his rounds. Careful notes should be made and the inspec-

tor asked for a written report containing his recommendations. When these are received the appropriate parties in the plant must be contacted to make whatever corrections are recommended in the report. These recommendations should usually be complied with by the time of the inspector's next visit. Also the plant safety inspectors, because it is their duty to be out in the plant constantly, can make daily inspections of wash room and shower facilities and report them to the medical and safety directors. Such facilities must always be part of the joint inspections of the plant made by the safety and medical directors. Any deviations from the recommended sanitary procedure will be brought to the attention of the proper authorities for correction. Follow-ups must be made to see that the work is completed.

Miscellaneous Duties

THE OTHER functions of the medical department, such as first aid and advice for non-occupational illnesses, health education, and general health supervision of plant personnel do not directly affect the safety department. However, even here the medical and safety directors can assist each other in several instances. The safety director in his talks to the employees can give emphasis to the fact that the medical department is established to serve as health adviser in any and all medical problems. By like token if the medical director notices that there is undue incidence of non-occupational diseases in a particular department he occasionally may find working conditions in that area predispose to illness. For example, upper respiratory infections may occur in high incidence in the employees working in an area in which they are exposed to high temperatures, with subsequent chilling when the men go home at night. A program can then be worked out, in conjunction with the department superintendent, to arrange for the men to take showers and change into dry street clothes before going home.

IN CONCLUSION I would like to say that I believe the foregoing statements have shown the advantages derived from close liaison with the safety director, especially in making plant inspections. These joint plant inspections lead to a better mutual understanding when programs for the prevention of illness and injury are being formulated.

Wound Healing and Early Ambulation

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EVERYONE who studies the history of medicine must agree that medical facts are "perennially discovered, discredited, forgotten, rediscovered and reaffirmed"[1] and that sometimes it is difficult—yes, even impossible—to answer the very simplest question.

In no other phase of medical inquiry are the above statements more apropos than in a consideration of the effects—good or bad—of early ambulation on wound healing. Wound healing is one of the enigmas which has intrigued medical investigators for many centuries. It is of more than academic interest for it is fundamentally a *sine qua non* in the success of any surgical procedure.[2]

First we may ask ourselves: *why* does a wound heal; second, *how* does a wound heal, and third, why does the healing process *spontaneously cease at the proper time* in most instances and, again, *why does this healing process persist,* in some cases, so that the resulting scars present definite evidence of overgrowth or hyperplasia—commonly called keloid formation?

In seeking the answers to these questions we discover that most authorities express their definitions or theories of wound healing as one integrated process without dissociating one phase from the other. After studying many proposals as to *why a wound heals*[3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13] the following philosophy seems to express all that is now known. It is stated thus: "What the stimulus to grow is, we do not know" . . . . that it is "one of the basic instincts, we have to accept."[5]

In considering the *modus operandi* or the manner in which a wound heals we find more unanimity of opinion[14, 15, 16] for the healing process lends itself to direct microscopic observation. It has been described as follows:[14] within a few minutes after peritoneal surfaces are coated with fine silk the angle between the apposed surfaces becomes filled with a "clear, structureless exudate." Within 10 minutes, fibrin bundles begin to form and within an hour or two these are fully developed. As these mature, they contract, drawing the wound edges together. These remain in position and form adult fibrous tissue within six or eight days without replacement by fibroblasts. This simple phenomenon does not obtain when bacteria play a part.

Others[15, 16] visualize the process of wound healing in terms of cell behavior. In a fresh wound certain cells act as phagocytes and clean up dead matter while other cells multiply in the fibrin network forming connective tissue; and still others are concerned with the growth of new blood vessels.

Thus, wound healing is divided into two phases: one in which the exudative reaction is most marked and the other in which the proliferative complex predominates. As the necrotic material is cleaned up, the exudative phase decelerates and the proliferative or fibroblastic phase accelerates. It is most important to note that until the necrotic material is removed and the exudative phase recedes, the actual bridging of the gap by mature, fibrous tissue does not proceed. Consequently, a wound develops little or no tensile strength *per se* until the exudative phase is minimal.

Thus (according to most investigators) the tensile strength of a wound is entirely dependent on the sutures during the first four days at which time the fibroblasts begin to proliferate and aid in holding the wound. This interval is termed the "lag period." Therefore, in order to hasten wound healing we must employ these procedures which will shorten the lag period, or to re-word it, shorten the exudative phase.

From the foregoing, it is obvious that we are confronted with a plethora of ingenious opinions and theories all cloaked in clever phraseology, yet all these demand a considerable acceptance in good faith. And, in essence, all of these mental exercises in semantics actually tell us relatively little. Without attempting to appear facetious, one might as well say that a wound heals because it seems to be "the nature of the beastie."

Although it is a matter of chagrin and disappointment that we are not able to find concrete or adequate answers to some of the questions propounded above, we do possess considerable knowledge concerning a number of factors which have a direct and indirect influence on wound healing. These may be divided into two groups: first, the general circumstances which obtain in the host (the patient) and second, local conditions found in the wound.[2, 17]

In general, the youth of the patient seems indisputably to enhance wound healing; and conversely, while there are many exceptions, advanced age of the patient appears to slow down wound healing.

The patient's state of nutrition is of considerable importance in wound healing. Such factors as dehydration of the tissues, inadequate blood-protein levels,[18] perverted balances of blood chemistry such as azotemia, hypo- or hyper-chloremia, hypo- or hyper-glycemia, and many other common aberrations in blood chemistry[19] all vitiate the customary train of events which result in normal good wound healing. In the same category of adverse influences are other such potent disturbances as severe anemia, chronic infections and debilitating diseases such as cancer, tuberculosis, etc.

If we fall victim to the enthusiastic wiles of the drug-house salesmen, it is neither relevant nor germane to our topic, but creditable evidence has been adduced which proves that vitamins are of real importance in wound healing. We refer specifically to a sufficient vitamin C level in the human economy.[20, 21] Also, many vitamin deficiencies almost certainly ensue because of general nutritional faults and perhaps other vitamin factors are more important than we now understand. Vitamin K occupies a preeminent position in the control of hemorrhage, and vitamin A deficits prolong wound healing.[22] Therefore, it is safe to state that the present-day furor concerning vitamins is at least partially true in its relationship to wound healing and not merely a passing, popular fad or fancy.

In reviewing the local wound factors[2, 17, 23, 24, 25] which are of utmost importance the incision itself would seem of considerable moment and in so far as possible the Langer cleavage lines should be followed. Moreover, so-called anatomical incisions are preferable to incisions which have only two endorsements: one, habit acquired of long usage; and two, a surgical exposure adequate for plowing around up to the elbows in the wound. Let him who argues that nerves and vessels may be severed with impunity or that the long muscle-fibers may be cut with *restitutio ad integrum* pacify any fleeting qualms with sophistries of his own invention. But to the reasoning surgeon, incisions based on anatomical considerations should have precedence over incisions dictated alone by habit and convenience to the operator.

Obviously, a cleancut wound made with the sharpest scalpel is superior to the chewing effect obtained even with the keenest scissors. And the so-called "radio knife" has a definite delaying action on wound healing.

In either the aseptic or septic wound, devitalized tissue represents one of the greatest barriers to early healing. This may result from mass ligation of tissues or from sutures which are tied too tight. The use of small, fine, hemastatic forceps is much better than the promiscuous use of large, heavy crushing forceps. Rough handling of tissues, blunt dissection or injudicious interference with blood-supply are all mentioned only for condemnation. Blood clots, fat globules and fat particles, large hematomata (due to inefficient and inadequate hemostasis) commonly act as a nidus inviting infection. All these evidences of imperfect surgical technic must be discharged from the wound or absorbed before the healing process can proceed. Dead space and inaccurate approximation of tissues must be deplored as a deterrent of good wound healing.

The numerous multicolored antiseptic agents and their effect on wound healing probably have been correctly assayed when such tinctorial artistry has been described as "chromatic surgery, rather than traumatic surgery."

One of the greatest technical aids we have found to enhance the healing of wounds particularly in clean, elective surgery is the use of a copious lavage with sterile saline. Not only does this mechanically cleanse the wound of blood clots, loose detached tissue and any other devitalized detritus in the wound, but it also tends to rehydrate the theretofore somewhat dehydrated tissues. This maneuver, with the aid of gentle gauze swabbing of the wound surfaces, also reveals any potential or latent bleeding points which may have been missed previously.

We believe that the use of sulfa drugs in the ordinary clean wound is not indicated. However, sulfanilamide micro-crystals are used routinely in the peritoneal cavity whenever evidences of a septic process are at hand. Dusting a superficial wound with sulfa drug probably increases the amount of capillary oozing and actually may impede wound healing owing to an increased exudative reaction.[26]

Probably no topic relating to wound healing is more widely discussed, the subject of more quibbling controversy and of the least importance—if analyzed within certain limits—than the choice of sutures and ligatures. Throughout the ages healers have extolled the virtues of so many types of ligatures and sutures and such verbal and written battles are rampant even today, that to say our knowledge of this subject is chaotic would be a gross understatement.

Many authoritative studies and observations have been made on the various types of ligatures and sutures. Many endorsements and criticisms of all types abound in medical literature.[27,28,29,30,31] However, the variations ascribed and attributed to these foreign bodies may be due in part to prejudices and enthusiasms displayed by proponents and opponents.

In our work we use cotton. This does not mean that the skin alone is closed with cotton. We tie off blood vessels, we invert the stump of the appendix; cotton is used from "cover to cover," if we borrow the idiom of the operating room. The finest cotton thread which will serve the purpose indicated for the various ligatures and sutures is the size of choice. It is bought at the dime store. It is boiled with the instruments. It is not waxed, greased, oiled, pomaded or otherwise pampered. It is cheap, easy to use, sterilized with certainty and creates a minimal tissue reaction. The technic is simple for the nurses and surgeons to acquire and the use of cotton has proved perfectly satisfactory.

In general, we know that plain catgut elicits more foreign-body or exudative response than does chromic catgut. We know that linen, cotton, silk, nylon, wire, cellophane, vitallium (and other metallic compounds) all—when introduced into the human body, under the most careful circumstances — evoke some, at least minimal, response. We know that the size of any foreign body used results in a somewhat mathematically-proportionate reaction, so that the use of the finest ligatures and sutures of any material is recommended. Therefore, one would expect the best healing to occur in those cases wherein the foreign body used for sutures and ligatures had the least exudative-stimulating potential and then only in the finest sizes possible.

We have no quarrel with those who use catgut, for the surgeon whose technic is as meticulous and fastidious with catgut as with cotton or wire will probably have approximately the same good results. In some cases we use catgut.

In the dirty or septic wound the surgeon is faced with a "fielder's choice." If he buries an unabsorbable suture or ligature in such a case he risks having a chronic draining sinus because the foreign body plus

the infection may make it impossible for the body to handle it.

Some authors do not believe this. They contend that non-absorbable sutures or ligatures may be placed in a dirty wound with perfect impunity. Such is not our experience, for we have had foreign-body sinuses. On the other hand, to place catgut in a frankly contaminated wound (such as a ruptured appendix with peritonitis) means that the surgeon hopes the manufacturer of the catgut is correct when he labels his product "10-day, 20-day or 30-day catgut." However, if there is any one thing we do know about catgut it is the unpredictability of its absorption rate. Without question of a doubt, what the manufacturer stamps on the label of his catgut is merely a rough index or gauge of its absorption. In any given case this assumption may be wrong by several hundred percent.

Therefore, the man who seeks the known tensile strength of non-absorbable sutures or ligatures in a frankly contaminated wound must balance the disturbing thought of a possible chronic, draining sinus with the unknown holding-power of catgut. Moreover, catgut knots occasionally do act as foci for draining sinuses.

The last of the general and local factors which influence wound healing which we will consider is early ambulation. The philosophy first enunciated many centuries ago that a wounded or injured part should be put at rest still has a large and tenacious hold (at least subconsciously) on most physicians. It is not within the purview of this discussion to present all of the theories which might be given to substantiate this concept. This thesis is so thoroughly indoctrinated that even to mention early ambulation after major surgery would at first smack of the iconoclast or the heretic. Yet, let us examine critically the pros and cons of early ambulation after major surgery.[32, 33, 34, 35, 36, 37, 38]

In the first place, prolonged bed rest is fraught with numerous complications,[33] mainly involving the circulatory system and the pulmonary apparatus. It is a proved fact that these complications are markedly decreased by early ambulation.[33, 35] Therefore, if one minimizes those complications (directly attributable to long bed-rest), what are the feared dangers or complications of early ambulation? Obviously, everyone fears evisceration or post-operative herniae.

How does a wound fare under the influence of early ambulation? Are there actually more wound disruptions or more postoperative herniae?

Many references from ancient and recent literature indicate that not only are the undesirable pulmonary[39] and cardiovascular sequelae of prolonged bed-rest diminished by early ambulation; but, also that the feared consequences of early ambulation, namely dehiscence of the wound[31, 40] and post-operative herniae, are not appreciably increased. With this observation we wholeheartedly agree.

Our experience would indicate that, if a reasonably ideal wound has been created on a carefully prepared patient, there are fewer pulmonary and circulatory complications; and there are no more undesirable effects on the wound with early ambulation than were observed in the past with long bed-rest. Early ambulation increases the circulation, generally and locally; it also increases metabolism. It has been proved that increasing metabolism shortens the healing time of wounds.[41] Therefore, early ambulation should (and we believe does) decrease the time necessary for the healing of wounds.

In addition to minimizing pulmonary and vascular complications, early ambulation reduces catheterization and the need of enemas, it improves the patient's appetite and general feeling of well-being, it shortens the hospital stay, it lessens the nursing care and the lost-time from work is markedly reduced.

At this point, one may ask: How early is "early ambulation?" Usually we refer to "early ambulation" as being not later than 72 hours post-operatively.

We would like to present our results in 949 herniorrhaphies, 1,198 appendectomies, 832 thyroidectomies and 482 breast operations. These are unselected consecutive cases. In the hernia cases two have had cotton suture sinuses. In this series we have had five appendectomies from which we removed cotton sutures (they were dirty cases), and none had post-operative herniae. We have never had to dig out cotton from a breast or a thyroid incision.

We wish to show slides which should puncture the balloon of complacency inflated by modernity:

> In performing of a Suture, ſix or ſeven general Precepts are to be obſerved; the firſt of which is, that the Wound be well cleanſed of all clots of Blood, and other exotic Bodies: Secondly, that its Lips be join'd by a Servant, who holds them cloſe during the Operation: The third is, not to take in too much of the skin, by piercing it obliquely: The Fourth, not to penetrate the Fleſh deeper than is neceſſary, to avoid leaving at the bottom of the Wound, a ſpace where the Humours may amaſs and putrify: The Fifth is, to leave a moderate diſtance between the Stitches: The Sixth, to avoid the puncture of the Nerves, Membranes and Tendons: and the Seventh conſiſts in ſometimes venting the lower part of the Wound, to make it an iſſue.

Another slide gives one man's opinion as to why a wound heals:

> The ſole advantage which we draw from Sutures is Re-union in the Procuration of which two things concur, the Chirurgeon and Nature. On the Chirurgeon's part the obſervation of two circumſtances is absolutely neceſſary: Firſt, to draw the Lips of the Wound to a mutual cloſure, and ſecondly to keep them in that ſituation; and on the ſide of Nature ſhe is obliged to make uſe of her Balm, as the Moſt proper Cement to conglutinate and mutually re-unite the Lips of the Wound. Be not ſurprized, that I put the Chirurgeon before Nature, ſhe would labour in vain on a Wound, if his Induſtry did not reduce the parts to ſuch a ſtate as is reparable by the Motion and Juices provided by her wiſe Oeconomy to that end. In order to conceive how this re-union happens, we muſt be informed that all the Parts of our Bodies are compoſed of nothing but Tubes, perpetually tranſfus'd by Liquors, which endeavor to diſperſe themſelves to all the Parts, and, by continual impulſe, incline to circulate from one Part to another: So that as ſoon as the Chirurgeon has cloſed the Lips of the Wound by Suture or Bandange, and ſubjected them to this Diſpoſition; the Humours, which are perpetually attempting to paſs and repaſs from one Lip to the other, finding the Conduits broken, flow out of the Veſſels, and their moſt glutinous and balſamic Particles ſtopping in the Intervals, which always remain in a Wound, even the moſt exactly clos'd, there condenſing and indurating by the heat of the Place, and withal joining to the two ſides of the Wound, they keep themſelves ſo united.

And this slide shows the source of this scientific material which, with slight change, might have been printed last year instead of over 200 years ago:

> A Course of
> Chirurgical Operations,
> Demonſtrated in the
> ROYAL GARDEN at Paris.
>
> By Monſieur DIONIS,
> Chief Chirurgeon to the late
> DAUPHINESS, and to the preſent
> Dutcheſs of Burgundy.
>
> Tranſlated from the Paris Edition.

The Second Edition

LONDON
Printed for F. Tonſon; and ſold by F. F. and P. Knapton,
A. Bettefworth and C. Hitch, G. Strahan, W. Innys and
R. Manby, F. Clay, C. Rivington, A. Ward, F. Clark,
F. Brotherton, T. Hatchett, R. Williamſon,
F. Cogan, and W. Feales. 1733.

We show these slides merely to emphasize a few points:

1. There are very few medical facts which literally are new. It is paradoxical and unbelievable (but it is true) that most medical findings have been "perennially discovered, discredited, forgotten, rediscovered and reaffirmed."

2. Today, no man can give a completely adequate explanation in response to the simple question: *Why* does a wound heal?

3. Several conventional explanations and theories have been presented as to the *modus operandi* or the mechanism involved demonstrating *how* a wound heals; but there is no satisfactory explanation as to why a wound stops healing at the proper time or why, in some few instances, a wound continues the healing process until an exuberant wound results.

4. We have presented some of the local factors involved in wound healing, emphasizing careful hemostasis, the use of fine suture and ligatures and small instruments, freedom from suture tension and rough surgery, a clean, lavaged, rehydrated wound, avoidance of heavy, mass sutures or ligatures, and closure of dead space.

5. Particularly, we would like to stress the preparatory phase in which the body physiological chemistry is equilibrated regarding fluid balance, proper electrolyte levels, establishment of carbohydrate reserve, optimum blood-protein level, kidney and liver function appraisal, vitamin replacement, and control or eradication of concurrent infection.

6. We believe unequivocally that early ambulation enhances the over-all progress of the wound and the patient considered as a whole. It is our sincere conviction that with proper attention to the general and local factors of a wound and with early ambulation, we, as surgeons, may approximate that status wherein we will fully achieve our objective: namely, the restoration of disturbed physiology in this, the greatest mechanism—the human body.

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Medicine and Research

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I HAVE been very much interested in industrial medicine and all medicine for many, many years. I sometimes think we do not regard health as the fundamental that it should be. It's one of our greatest natural resources. So anything we can do to protect it, and to broaden the fundamentals of better care, is very, very basic and deserves every possible attention.

These days we hear a lot of discussion about various kinds of medicine—this kind, or the other kind. You have heard complimentary things said about doctors, and you have heard some that haven't been so complimentary. I'm not here to talk for or against. I would like to present a record and then have you draw your own conclusions.

We have had within our lifetime two wars, and we have the records of those two wars. If anyone can find any line of human activity that has made greater progress than medicine has between these two wars, as indicated by the records from World War I and World War II, then you can believe what the "antis" say about the medical work of our doctors.

I have been associated with doctors for a great many years. I don't think doctors are a bit different from any other group of people in the world. I think they are just the same kind of folks as merchants and lawyers and preachers and everyone else.

The medical profession is one of the oldest professions we have. I don't know whether you ever looked at it this way or not. People got sick when we knew very much less than we do now, and the doctors became conscious of themselves, or people became conscious

of the need of doctors after they were a finished product. In other words, people, so far as their general make-up is concerned, haven't changed in thousands and thousands of years. The Oath of Hippocrates that the doctors take was originated in 600 B. C., which shows how long people have been thinking about medicine.

Now we sometimes forget and we sometimes overestimate how much we know. This is because we don't realize that this biological specimen we call a human being came here already developed, and then we try to fix it when something goes wrong. We have five senses. We think we understand a little bit about how we can see and how we can hear. But we don't know very much about how we can feel, and we haven't the slightest idea about how we taste and smell. I think there's a new world on the side of each one of these when we understand their mechanisms. However, this is not a doctor's problem; it is a physicist and scientists' problem.

It has been proved that the human eye can see in the dark the minimum amount of light that it is possible to get from an object, which the scientists call one point of light. This work was done, I think, at Columbia, where Dr. Hack determined whether owls could see better at night than human beings. There are a great many fantastic stories about the fact that owls can see or can sense an object because of its heat. A lot of people, however, doubt this. The result of Dr. Hack's very interesting study found that a man can see just as small an amount of light as an owl, but an owl can see it much quicker. If a human being and an owl were put in a dark room with a luminous object, the owl would detect it in a very much shorter time.

During the war we had flyers who developed so-called "cat-eyes," which was done by feeding them carrots and keeping them in the dark. All this did was speed up their rate of being able to see. Of course, you can see an object a little bit better if it's off to one side than if it's in front of you, because of the construction of the optic nerves. I am mentioning that because we are in the greatest optical city in the world here in Rochester. Cameras and optical devices of all kinds are developed here, but I don't think we have a camera that will detect as small an amount of light as will the human eye. Man has made great advances in developing the camera and microscope, but our eyes never had any development. We just inherited them. I don't know how many million years have passed in the development of the human eye, ears, taste, etc.

Dr. Hack came to the conclusion that the reason the human eye can see as small an amount of light as an owl is self-preservation. If the human being or the owl didn't see the thing that was after them they would get caught by it. So the laws of necessity and self-preservation have driven us to developing our senses to a degree of precision and sensitivity which is perfectly remarkable.

Now we ask the doctors to come in and take this finished human product and know all about it right from the start. Supplemented on this are the mental and psychological reactions of a lot of people who think they know more about medicine than the doctor does, so that complicates it.

We have two intelligences: one is the instinctive intelligence which got us here, and the other is our cultivated intelligence which will take us on out of the mess we are now in. We have to work that one out.

So doctors started with a very great handicap because the human being is not a single type of entity; it's physics; it's chemistry; it's biology; it's all sorts of combinations. The doctors have been utilizing everything they can get from the allied sciences, in addition to their own practices, to try to come up to the point where they can say, "If you do this and this, we can correct it." Supporting the fact that they have made progress, I simply offer the result of the two World Wars as proof. The advance in medicine and medical practice has been just as great as, or greater, than that of any science or profession. But what we must think about in the long range is what we can do to prevent things from happening, rather than fixing them after they have happened.

General Motors has started a clinical examination of executives, and we would like to carry that on down the line. I won't burden you with my own screwy idea of how it should be done, because it would start an argument. But to give you an inside track of what I think, I believe a man should go through a clinic in two hours and 15 minutes. However, the doctors think that's a little too short.

I have to tell the corresponding story about that. Many, many years ago we developed Duco as a finish. Maybe two hours and 15 minutes might be absolutely the wrong time for a clinical examination, but I know it's short enough to start an argument. On the other hand, maybe it's entirely too long. Perhaps 15 minutes is the right length of time. Well, anyway, it took us 35 days to paint one automobile. It was taking Cadillac 35 days and Buick 17 or 18 days, because one put on three or four more coats of paint than the other. We were going into making closed cars. I figured if we were going to make the number of closed cars we should make, we would never get any of them out at the rate of 17 or 35 days drying time for each car.

I started to see if we couldn't reduce the time. I did the perfectly logical thing, which proves you never should do it, and invited all the experts in the country in to talk about it. I got paint manufacturers, expert painters, chemists, and all that sort of thing, and I told them the story. I said we had to do something to cut down the drying time, so we discussed the pros and cons. The paint manufacturers said the trouble was that we didn't pay enough for our paint, so you can see what they were thinking about. The chemists said they were making as good a paint as was possible. The fellow who put it on said you never could do anything about it at all. We argued until noon and then went out to lunch. As we were going out, I heard one of these fellows say, "I think we will put this guy back in the corner where he is going to stay"—speaking of me, but I pretended I didn't hear him.

After lunch we got back and I thought, "I'll start this argument another way," so I said, "Two or three of us have been talking about this paint business during lunch and we came to the conclusion that the maximum time it should take to put five coats on an automobile is one hour."

Well, that really started an argument. They said, "Of course you can't do that because you can't get the paint to dry in that time. Even a child knows you can't get five coats of paint to dry in an hour. In fact you can't get one coat to dry in a day."

"Well," I said, "that's your problem."

I'm going to stop here and tell another story. When you have a thing like that, an incentive, then you begin to look around. It's like buying a camera. When you buy a camera, whether you take any pictures or not, you see four times as much as you ordinarily do, because you are constantly looking for things to photograph. I bet a friend of mine that if I gave him a

bird cage and he hung it up in his house he would have eventually to buy a bird. He took the bet. So, I hung the bird cage up in his house, and people would come in and say, "Joe, when did your bird die?"

He would say, "I never had a bird."

And then they would say, "Then why have you got a bird cage?" In the end it was much easier to go out and buy a bird and put it in the cage than it was to answer all the fool questions. So this mental quirk has set up a mental bird cage for us, and we have to put something in it.

I was walking on Fifth Avenue one day and in a jewelry store window I saw a little ash tray. It was a 75 cent ash tray, but I paid $11.50 because I bought it on Fifth Avenue. I asked them where they bought it and they told me a fellow over in New Jersey made them. I went over there and wanted to buy a quart of the lacquer he used on the ash trays. It was slightly tinted and it wasn't a real paint, nor was it a clear lacquer. He said, "What do you want to use it for?"

I said, "I want to use it to finish an automobile door."

He said, "You can't paint a door with that stuff."

I said, "Why?"

He said, "You put it in a spray gun and it will dry before it gets over to the automobile. It just dries too fast, that's all."

Well, the paint fellows had told me their paint took a long time to dry so I said to the ash tray maker, "Can't you do anything to slow it down?"

He said, "Not a thing." So there I was between one that dried too fast, and the other that dried too slow. I said we ought to be able to breed these two things together and, after a number of years, we finally succeeded in doing it.

When this was done I asked the man who had said he was going to "put this guy back in the corner where I think he'll stay for a while," to drive down and see me on a very fictitious pretense. He came down and parked his car in front of the laboratory. I handed him some paint color cards and said, "Joe, if you were having your car refinished, what color would you choose?" He picked one out and then we went to lunch.

When we got back in front of the laboratory he suddenly yelled, "Hey, someone's taken my car."

I said, "Isn't that your car over there."

He said, "That isn't my car; it wasn't that color."

I said, "That's your car. You wanted it painted. So we painted it for you. I had the fellows give it three coats of paint while we were at lunch." You should have seen the expression on his face.

Well, we had quite a battle, but we finally got the paint, and now you can actually put on five coats of paint in an hour and do a high-grade job. But you can't accomplish these things in a minute. It takes time —a lot of time.

You have seen those scales that you step on, drop in a penny and get both your weight and your fortune. I want to work out a diagnosis scale like that. Drop in a penny and out comes your complete diagnosis—blood count, temperature, everything about you, everything you need to know.

The boys don't think it can be done. But I think that some place between that scale and the week you sit around outside a doctor's office waiting for him to call you, there is some spot in between where these two can be brought together.

I would like every employee in General Motors to have one of these cards, no matter how he gets it. Then when he gets sick he hands the card to the doctor and the doctor has a place to start from.

We do need a much more rapid way of getting a specific diagnosis, or at least an evaluation and inspection of this very marvelous organism we call a human body. Don't blame the difficulties on the doctors because I don't think they are any more to blame than the people. I think the scientific people have got to come into this thing and help. It doesn't make any difference whether we get it tomorrow or five years, or 10 years from now, but we should be working in that direction.

It's like one of our great writers said to a young fellow, "Son, I want to tell you something. Don't wish too hard for anything because some day you are going to find you have it." I think if you know what you want it's amazing how much shorter time it takes to get it than you might normally think it would.

I am ready to trust the doctors with the job of engineering this diagnosis scale idea of mine. I don't want to be a doctor, but I would like to be a doctor's helper or a doctor's assistant. And I know they could do this thing, and if we can help them, that is one of the things we will ultimately get. If we have 350,000 or 360,000 people working for us; we ought to have 350,000 or 360,000 cards. I would like to have 40,000 go through the clinics in Dayton, and I have given the doctors there the problem to see what we can do. How long will it take to get 40,000 cards? It doesn't matter whether we do them in a year, but we want to know how long it takes.

THIS is a good time to have a meeting like this, because During World War II we learned a lot of things about mass handling of people. When you think of the casualties it is about 1% or 1.5% of the total number in the Armed Services. That is very low. It is so low that it is hardly believable. And we have had no epidemics, no plagues; nothing of that kind has come along, which is the first great war that something of that kind has not followed; so that in itself shows we have learned a lot. We have the sulfa drugs and penicillin, but they are not final. They are just the beginning. Penicillin is the first one of many possible mold products; so we are just beginning. The biochemist and the physiochemist can help a lot on this remedial thing. So the future of medicine can be almost anything you want. We can set an age, maybe 70 or 75, and everybody should live to that, and some of you will live longer than that. We know now that the old idea of three score years and ten can be changed.

Health to me is so important that there ought to be some sort of health education, not only to give people information about health but to show them what health is. And I believe it should be started even as early as the kindergarten, or at least the first or second grades.

You don't have to send the children to the family doctor these days—we have enough of them on the radio. It is really amazing that we need any doctors at all—we can just listen to the radio. But somehow these radio doctors don't work out, and of course they haven't any responsibilities. The sponsors, however, get great results from this radio advertising.

Dr. Mee said that perhaps no country in the world was greater for falling for patent medicine advertising than England. I don't think he has listened to the "Crazy Water Crystals" program. We sent out and got some, and it was nothing but Epsom salts. They sold it for $1.25 for a quarter of a pound, including delivery. You can get a pound for five cents at the corner drug store, but you would have to go and get it yourself, and, of course, the glamor is all gone when you buy it at the drug store. "Crazy Water Crystals"

was supposed to be made of some marvelous water found down in Texas, so that enhanced its value very much.

The gullibility of people on buying these things is manifested by what has happened in various cities. We have two or three buildings in Dayton that were built by Tamarak and Peruna and companies like that.

I was talking to a newspaper man the other day who said the public was greatly confused, and I said, "I don't see how they could help be if they read your newspaper." So that started an argument. But it is true, the public doesn't know whether we are going into a world of development or into a world of chaos. I think that depends on the kind of a world we would like to have. As far as our being finished up is concerned, we know so little about any of the things we are doing that the opportunity for human progress is just anything you want to make it. You can write your own ticket.

One of the things I think that we have sensed is that we have over-estimated how much we know. During the war we had radar which was quite a new thing. But radar is exactly the same as if you snapped on a flashlight and saw something on the wall on the other side of the room. The rays send little impulses out, which reflect back.

That is quite a new thing, and yet we find that bats have been using something like that for 10 million years. It is called supersonics. It is a sound radar. If you let some bats in here you could hang up all sorts of obstructions and blindfold the bats and they would fly through those obstructions without any difficulty. In fact, they could fly better blindfolded, perhaps, than with their eyes open.

It was found that bats let out little impulses of sound away above the ability of ears to hear, and those sound waves echo off the sides of objects and walls. The bat had to work out that system if he was going to live in a dark cave, so he said to himself, "If I've got to live here, I've got to get around without bumping my head," and he developed his sound radar.

Now we have instruments capable of measuring the high pitched sounds the bat can give out and they are only 10 years old. Medium pitch is about 15,000 to 16,000 vibrations a second. The middle "C" on your piano is 256. The bat goes up to 75,000 to 80,000, and it is very interesting that he sends out a certain pitch and he can tell from the first echo he gets back whether the object is big or little. He does a beautiful job. Up at Harvard they had wheels with spokes spinning around and the bat would fly right through without hitting a spoke. When they took the blindfold off, he would hit the spokes once in a while.

We have found, too, that the ordinary house fly has a complete gyro control mechanism which is actually an automatic pilot. That is, he can fly in a perfectly straight line and do it automatically. He has a gyroscope under each wing, a couple of little things called halters which vibrate with the wings, and which make him fly in a perfectly straight line. It is interesting too, that the nerve system which he uses to control the muscles in his wings is exactly the same type of mechanism as is used in our automatic telephone system.

Now we think we are pretty smart because we can fly airplanes without pilots. But Dr. Gilmore of the Sperry Gyroscope Company told me that to prove to his engineers that we aren't so smart he got all the papers together to show them that they were only 35,000,000 years behind the fly, and to show them what a great opportunity they had to catch up with it.

So the first mechanisms were developed when the world began, yet we pat ourselves on the back for what we have discovered and for what we know. I think if we would go back we could learn an awful lot from nature. When we recognize that what we do know about nature is so small, compared to the possibilities, there is a whole new world ahead of us. By doing that I have been learning things for a great many years.

There is the research we have been doing down at Antioch on how the plant can pick up the energy of the sun through the green leaf, because that is the only thing that stands between us and starvation. It picks up all of our food and fuel and our coal—but it doesn't pick up atomic energy. The mechanism in the green leaf is the reason why we are on this earth. But we don't know enough about nature, and that prevents us from finding out what this mechanism is.

The only reason we have found out anything about it is because it is not what we think it is, and we approached it from that angle. But some day we are going to find what it is. Try out everything, and then after you run out of things, try the ones you didn't try, and the chances are you will find out.

There are two things about education: We overestimate what we know in the first place; and in the second place we believe that education gives us a volition, or that we can do this, that or the other thing. The second belief has gotten us into ruts.

I suggested to a friend of mine that it would be worthwhile to write a book on "Groovology." If you are in the groove, try to get out, and try to get out without being wrecked. We have a couple of grooves that are difficult to get out of. Take for instance the gauge on our American railway system. It would be better if it were wider, but we can't change it. Therefore, not being able to change it, what is the best we can make out of it?

We get into a lot of other grooves. We write some grooves ourselves and then read them and finally we believe them. But if people come along that don't know that things are supposed to be the way they are written and try out their own ways then sometimes they find different answers, which is what we are after.

The subject of vaccination is rather interesting. Dr. Green up at the University of Minnesota found out that if you gave a cow or a horse a disease and then made a serum from the infected animal and injected it into a human being the human being became immune to that disease. Dr. Green, in working with dog distemper found if he gave a guinea pig a distemper injection from the infected dog the pig didn't have it very bad. Then he made another serum and gave it to a dog and the dog had it almost as bad as the first time. This reinjection process went on up to the tenth time, and then the guinea pig died. At the ninth transference the guinea pig got very bad, but the dog was cured, which should not be, according to theory.

I am telling you this story because that is the way it is. When it is written up nine times in a book, you believe it, and no one questions it. So we have to work backwards as well as forwards in fundamental research. We have to ask, why do we do it this way? It may have been perfectly all right 10 or 15 years ago, but in the meantime a lot of things have come in and completely changed it.

Our chief metallurgist got a gold medal for leaving out an operation in making iron castings which saved about two dollars a pound. He didn't know the castings had to be made a certain way so he made them without this particular operation and made them better; and he got a gold medal for it.

We sometimes can do as much undoing things as bringing in a new idea, and I think you deserve more credit for undoing things.

Another thing—I do not think we have fully estimated or have taken into proper account the things that we call "small things." In our work at the Laboratories we have found that out, part through accident and part intelligence. We trip over this or that and then we get intelligent about it.

A little malleable iron foundry at Buffalo had a reputation for making good malleable iron castings, so somebody thought it would be a good idea to enlarge it, and then they didn't get good castings any more. So they went back and made them as they had before, and they got good castings again. They found that the principal thing they had changed was that they got all the pig iron from a little blast furnace, and when they got it from other blast furnaces it wasn't so good. So our boys brought samples of the good and bad castings and put them in front of the spectroscope and found there was half a thousandth of 1% of tellurium in the good castings. That is quite small, and can't be detected by ordinary methods of analysis. They then put in a little more and reached a maximum of one thousandth of 1%, which had this very amazing effect —annealing time was reduced from 72 hours to 36 hours, and later to 24 hours. A thousandth of 1% is one pound in 50 tons.

I am mentioning this because I am perfectly sure there are a lot of small things that are important. As we know, adrenalin is one part in 10 millions. We are slowly coming to recognize small things as being very fundamental, and doctors are gradually creeping up on a realization of the importance of chemicals.

So I think this General Motors Medical Conference is very important for many reasons. It brings the educators and the industrial people together. They can begin to lay out procedures. At first it will go very slowly, and I think a great many people will get discouraged when they start to do the little things because they don't know how fast they should go. If you start to walk from here to Detroit, you may get tired when you have walked 10 miles and feel like giving up, but that doesn't change the distance from here to Detroit. Sometimes we don't know how far these things are, and then we give up.

We have all seen plants grow. You plant the seed, and if you watch it every day it seems to grow very slowly, and then it seems to grow fast. Ideas grow just like seeds. Some grow slowly, some grow fast, and some don't grow at all; in fact, most of them don't grow at all, and that's why you have to have a lot of ideas because only once in a while do you get a good one. That is the whole philosophy of research.

As I said, we have this idea that we can have volition about things. We can will that it go this way or that. We go out and we try to check it on both sides. We want to set up a difinite course, but to be safe we should set up three on each side of it.

I have driven from Dayton to Detroit many, many years, and we have our stock time—I think it is about four and a half hours. A friend of mine in Dayton said one day, "I don't believe you drive from here to Detroit in four and a half hours. I can't do it."

So I said, "All right, drive along with us Friday."

We got to Detroit in four hours and a quarter, and he said, "Well, no wonder you do it—you don't stay on the main road." That was exactly the reason—we didn't drive any faster than he did, but we didn't drive through the towns and hit all the lights; we knew the side roads, not only three on each side of the main route but half a dozen on each side, so we could make it in that time.

So we sometimes lay our plans too closely, but if we get off and look at them from a distance we can usually see why a thing doesn't work right. There are very few things in a research laboratory which can have a definite course.

We had two men from Switzerland come over to investigate our work on Diesel locomotives. It happens that in the Diesel locomotive the engine we use is a very unconventional piece of apparatus. It is very much off the beaten path. One gentleman said, "How do you go about getting into the mental attitude that you could possible make that sort of thing?"

I said, "We don't get into a mental attitude. We set up a single cylinder engine and we gave it a half a dozen pistons, and it said, 'I like this one better than the rest.' It picked out the things it liked best and just designed itself by our giving it an opportunity and not telling it how it was going to go." It was perfectly amazing how well it worked itself out by that method, so it runs about 10 times as well as any other engine.

So you have to devise the different things and let them do the selecting. One thing very much off color is the pistons we use. We took them down to a Society of Automotive Engineers meeting in Detroit one time. We had a new piston and one of the old type. Just for fun I put the price on the old piston which had run 50,000 miles at $100, and the new type of piston that had run a million and a half miles at $50. Then I had one of the boys listen in on the conversations of the people looking at them. I went down there myself, too, and there was a fellow there looking at the pistons. Pointing to the new piston he said, "I wouldn't take that one if you gave it to me. I can tell by looking at it and by the price that it's no good."

I said, "Were you ever a piston or Diesel engine"?

He said, "No."

I said, "Then how do you know where to look? The Diesel engine says it liked that one better, and there is this comparison of 50,000 miles to a million and a half, so it must be better."

He said, "I can still tell by looking at it, it won't work."

The word "research" as we look at it is another way of saying you don't know but you are willing to find out. If we knew things we would not be doing research at all. It is perfectly amazing how intelligent these jobs are if you let them lead. Set up an experiment and follow it and it will lead you straight to the right thing. You must not say, "We must not make that turn," because you have got to follow the experiment and let the job do the leading.

We had a job to do many years ago, a gasoline job, and we started it in a tobacco warehouse. There was electricity but no water, and we had to cut a hole in the floor to get water. I put a fellow on this job who had never had any chemistry. He said, "I think you ought to get a chemist."

I said, "Why? We don't know anything about this. A chemist doesn't know anything about it. That is what I am afraid of. These fellows are going to try to climb a high mountain. We don't want any heavy packs on our back. They have preconceived notions." That young fellow never had any chemistry; perhaps he never even had a test-tube in his hand. Incidentally, he was a graduate of Cornell in mechanical engineering and later became president of the American Chemical Society. His name was Thomas Mitchell and he did a swell job.

We let the course we take stabilize our thinking.

After all, all you can get out of an education is procedure and a way to find specific information.

So I think these things we are establishing are a worthwhile procedure that is going to result in a revolution. It will not be a revolution, but rather an evolution, because it will be slow—an evolution in our thinking in medicine, that has to do with that great thing called health—the most fundamental thing in the world. It is going to change our notions about hospitals and everything connected with health.

My compliments to the medical profession in general for having done a marvelous job. We realize there is still much to be done, and you have our very sincerest cooperation.

Integration of Medical Services

WILLIAM S. McCANN, M.D.

THE MISSION OF MEDICINE. The ultimate aim of all cultural activity is the perfection of man's adaptation to his environment. Great Art is concerned with spiritual environment, Science with physical environment; Medicine stands between—is concerned with both Art and Science, charged with the health of the mind of man no less than with his body.

ENVIRONMENT has many aspects, both internal and external. The internal environment is maintained by homeostasis in the fluids which bathe the cells. The external environment is both physical and social. In civilization the social factor is now of greater importance than are climate and weather. Complete health exists only when adaptation is successful in all aspects of environment; Disease arises from difficulty in adaptation; Death results from failure to adapt.

THE SYMPTOMS OF DISEASE may be shared by both normal and abnormal persons. Their *intensity* depends upon the ratio. Demands imposed by environment: capacity for adaptation to environment.

NORMALITY is assessed by measuring the capacity for adaptation which depends on anatomical, physiological, and psychological factors or adaptive mechanisms, which maintain constancy of conditions in the "milieu interieure" through a wide range of change in the external environment, both physical and social.

It is man's capacity for social adaptation which has given him such great control over his physical environment. Man's adaptation to his external environment is now more dependent on his psychological attributes than upon his purely physiological capacities, since he compensates for his limitations in the latter by the use of his intelligence in planning, inventing, and coordinating group activities to control physical conditions in which he lives.

The normality of the social adaptations of man is determined in part by *inheritance* of normal structures and functions, especially of the nervous system and ductless glands; but it is largely the result of systematic training or *conditioning* of the members of a society to a common "mores."

Emotional reactions occur when socially conditioned "moral" behavior is in conflict with action motivated by primitive instincts inherent in the genetic pattern. These reactions disturb the normal processes of homeostasis. When the conflict is prolonged over a sufficient time, or frequently repeated, the resulting functional disorders are capable of producing changes in organic structures.

Disease may be defined as a state in which the capacity for adaptation has been impaired by a pathological process, so that symptoms of ill-being are evoked by environmental conditions to which normal individuals adapt with ease (without awareness of discomfort).

The age of *specialization* in which we live has developed an enormously detailed knowledge of pathological processes and of the disorders of structure and function in disease. The differentiation of specialists is wholesome and profitable insofar as it permits members of the medical profession to employ to the best advantage their individual skills and aptitudes. Nevertheless, the law of diminishing returns begins to operate when the specialist does not function as a part of a well integrated team. We need today men who specialize in integration, who function as the conductor of an orchestra which produces a symphony concert by a harmonious and perfect coordination of the efforts of specialized experts. Such a "conductor" of medical practice needs the basic training of both internist and psychiatrist if Medicine is to achieve its mission.

Authors' Abstracts

Non-Bacterial Pneumonias

JEROME T. SYVERTON, M.D.: Bacteria, viruses, rickettsia, fungi, protozoa, toxins and allergens are accepted as causative agents of pneumonia. Many of these agents are newly recognized. Intensive studies in recent years accelerated the disentanglement of etiologic entities from the complex of pulmonary infections designated clinically and pathologically as pneumonia. The sorting process was facilitated by the development and application of new diagnostic laboratory methods, by general acceptance and use of sulfonamide and antibiotic therapy, thereby eliminating from consideration most bacterial pneumonias, and by the concerted action that resulted from the exigencies of the war. These points are considered in this presentation which gives a brief resume of some of the present knowledge of the non-bacterial pneumonias, examines briefly laboratory techniques available for their study, and touches on the indications for sulfonamide and antibiotic therapy.

Epidemiology of Streptococcal Infections

BURTIS B. BREESE, M.D.: The control of infections due to beta hemolytic streptococci was the most important single medical problem in this country confronting the Medical Corps of the Navy. At Farragut, Idaho, which was the second largest Naval Training Center in the country, streptococcal infections were rampant—scarlet fever, tonsillitis, otitis media, mastoiditis, pneumonia and empyema were frequent. As a result of such infections rheumatic fever was very common. Chemoprophylaxis with sulfadiazine was at first highly successful in controlling these infections. Doses of as little as 0.5 gm. daily seemed effective. However two strains—Type 17 and 19—both developed sulfa-resistant clinically and in vitro. Following this development of resistance, an alarming outbreak of streptococcal infections occurred. Closing of the camp to new recruits finally controlled the epidemic.

Recent Advances in Disease of the Liver

JACOB D. GOLDSTEIN, M.D.: Very significant advances have recently been made in our understanding of certain mechanics of liver injury and repair. Experimental liver injury has been consistently produced by varying the casein intake in certain animals. By this method damage graded from fatty degeneration to total necrosis has been produced. The addition of casein in varying amounts and at different periods has resulted in repair with varying degrees of cirrhosis. Investigators are in agreement that methionine or the combination of choline-cystine are the significant elements necessary for the prevention of necrosis and the promotion of repair. Chemical data have demonstrated the usefulness of methionine and/or choline-cystine in human liver cirrhosis. The nature of the diseases termed infectious hepatitis, hepatitis from homologous serum administration, and yellow fever vaccination jaundice has been somewhat clarified. Transmission of each to humans has been accomplished. The agents involved have not been identified. The occurrence of nonicteric hepatitis has been established by laboratory evidence. The possible prevention of this type of jaundice by gamma globulin administration is under investigation. The laboratory evaluation of liver function involves the use of a "battery of tests."

Recent Advances in Hematology

JOHN S. LAWRENCE, M.D.: This discussion will be limited to a consideration of some of the more significant recent advances. Those relating to hemolytic anemias and the Rh factor will not be included as they will be discussed by others. The most striking development in leukemia is the demonstration that urethane will produce much the same type of remission as roentgen irradiation. The limiting factor with this form of therapy seems to be the nausea and other gastro-intestinal symptoms. Another recent development in this same field is in the use of the nitrogen mustards. These substances will produce a reduction in the white blood cell count and some diminution in the lymph nodes in chronic leukemia. Their use is limited by the marked effect they have on the hematopoietic system. Another piece of work has shown that the white blood cells remain in the peripheral blood only a short period of time—the total number of white blood cells in the blood is replaced about 1½ times in 24 hours in the cat. The anemia of infection has received intensive study. The plasma iron level has been found to be low in this type of anemia. The clinical entity of thalassemia minor has been firmly established. It has been shown to have an incidence of 4% in the Italian population of Rochester, New York. Hypersplenism has received much attention. There is no doubt that removal of the spleen in well selected cases of anemia, leukopenia and/or thrombopenia results in marked benefit. The main development in the coagulation field is in the use of fibrin foam and thrombin in the control of local hemostasis. The anti-hemophilic substance obtained by plasma-fractionation has been used successfully in some hemophiliacs. However, it has not yet been given over to general clinical use. By far the most spectacular recent development in hematology is the demonstration of the remarkable effect of folic acid on the macrocytic anemias.

The Red Blood Cell as an Immunologic Tool

LAWRENCE E. YOUNG, M.D.: Because of its remarkable and long overlooked immunologic properties, the red blood cell is being recognized as a valuable tool for investigation of important biological problems. The investigations reviewed fall into three categories: (1) Studies pertaining to the biology of the erythrocyte itself—its formation, destruction, preservation and transfusion, its relationship to the action of the spleen and of irregular antibodies and of certain chemical and physical agents. The Ashby technique, with its various modifications, is used in most of these investigations. This technique involves the transfusion of group O blood to A,B or AB recipients, or the transfusion of blood which differs from that of the recipient with respect to the M and N factors. Following transfusion, the donated cells can be differentiated from the recipient's cells by mixing a sample of the recipient's blood with an appropriate serum (A, B, anti-M or anti-N) which will agglutinate only one of the two types of cells present. (2) Studies on the use of red corpuscles of various species in diagnostic laboratory tests for certain infectious diseases. Particular reference is made to sheep cell agglutinins and cold hemagglutinins, and to the agglutination of red cells for influenza virus. (3) Studies on antibody production. Both the depression and the enhancement of antibody production by dietary and chemical means are readily observed in immunization experiments employing erythrocytes as antigens.

The Rh Factor

DONALD H. KARIHER, M.D.: The Rh factor seems to be of importance in only two spheres of medical knowledge: (1) transfusions in which Rh incompatible blood is used, and (2) the production of hemolytic disease of the newborn (erythroblastosis fetalis). These two apparently divergent fields are actually closely allied by means of the Rh factor. The Rh negative woman who has been sensitized to the Rh factor, through having previously received Rh positive blood, can deliver an infant with hemolytic disease of the newborn. The Rh negative woman who has been sensitized to the Rh factor through previous Rh positive pregnancies, and thus has given birth to one or more infants with hemolytic disease, will have a transfusion reaction if given Rh positive blood. Because the Rh factor reaches its peak of importance in the field of obstetrics a plan is described for carrying out routine Rh and anti-Rh (Rh antibody) determinations on all pregnant women. The results of such a plan were presented.

Left to right: DR. EARL L. LUTZ, Associate Medical Consultant, General Motors Central Office; DR. EDWIN J. NUGENT, Medical Director, Rochester Products Division, Rochester, New York; DR. A. WILLIS HUDSON, Medical Director, Chevrolet Gear & Axle, Detroit; DR. MAHLON R. SUTTON, Medical Director, Buick Motor Car Division, Detroit—on the occasion of the presentation, Monday evening, July 29, of Continuous Service Awards to DR. HUDSON and DR. SUTTON in recognition of the completion of 31 and 30 years respectively of Industrial Medical Service with General Motors Corporation. DR. NUGENT was the General Chairman of the Meeting, and DR. LUTZ assisted DR. SELBY with the Central Office arrangements

Function of the Lung in Abnormal Circumstances

NOLAN KALTREIDER, M.D.: The function of the lung is two-fold, ventilatory and respiratory. Failure of these two functions results in pulmonary insufficiency. When ventilation fails dyspnea results, while cyanosis and retention of carbon dioxide appear when the respiratory process is impaired. Normally the functional reserve of the lungs is great and only very severe exercise will produce symptoms. Certain pathological processes will decrease the ventilatory reserve, thereby reducing the dyspneic level. The maximum ventilation will be reduced when lesions involve the thoracic cage, the tracheobronchial tree or the lung parenchyma itself. Increased breathing requirements will also reduce the reserve. Normal and abnormal factors that stimulate the respiratory center will increase the breathing requirements. Inefficient alveolar ventilation, difficulty in diffusion of gases across the alveolar membrane, circulation of portions of the lung without ventilation, congestion of the pulmonary capillaries, etc., will result in anoxemia, respiratory insufficiency. Usually, though, these two functions of the lungs cannot be so clearly differentiated in any one case because frequently both are involved. Chronic pulmonary diseases such as fibrosis and emphysema lead to diffuse bilateral disarrangement of pulmonary function resulting in disability. Certain function tests help to detect the nature of the abnormality and to evaluate the extent of the disability. In other pulmonary diseases where the lesion is unilateral, it is important to study the function of each lung separately. This type of investigation is particularly important preceding irreversible operations on one lung, such as thoracoplasty, lobectomy and pneumonectomy. Finally, the symptoms and signs of pulmonary and cardiac insufficiency mimic each other so closely that it often becomes difficult clinically to differentiate these two conditions. Certain laboratory procedures will be discussed which at times help to distinguish these two conditions.

Left to right: DR. GEORGE A. PAUL, Hyatt Bearing Division, Harrison, New Jersey; DR. F. APFELBAUM, Hyatt Bearing Division, Plainfield, New Jersey; DR. W. L. BAUGHN, Guide Lamp, Anderson, Indiana; DR. S. D. STEINER, Oldsmobile, Lansing, Michigan. DR. STEINER is explaining a point between lectures at the University of Rochester

The Treatment of Hyperthyroidism

LAWRENCE A. KOHN, M.D.: Surgery in an induced remission by iodine or perhaps occasionally by thiouracil remains the most rapid and predictable method of treatment of toxic nodular or toxic diffuse goiter. X-radiation seems limited in value to diffuse toxic goiter in the young. Radioactive iodine is still under investigation. It offers a hope of metastatic carcinoma of the thyroid with symptoms of hyperactivity. Of the anti-thyroid drugs, thiouracil has now become accepted as reliable, but produces intoxication in a small but certain number of cases. Whether the remissions induced by anti-thyroid drugs will persist is still not known. Derivatives of thiouracil continue to be produced and studied and may prove superior. Whatever the reasons prompting their use, patients under anti-thyroid therapy must be carefully observed. It is as important as ever to plan therapy in every case, and not to administer iodine or thiouracil until a long-range scheme covering all possibilities has been established, preferably with the advice of a surgeon.

Pituitary, Adrenal, and Gonad Inter-relationship

E. HENRY KEUTMANN, M.D.: The inter-relationship between the pituitary, the gonads, and the adrenals is sufficiently understood to permit certain generalizations and simplifications. There is close relationship between the pituitary hormones which control the gonads and those controlling the adrenals; there is even evidence that in part one hormone (L.H.) exerts influence over both. In their influence over various metabolic processes, some of the hormones produced by the gonads and adrenals have similar action, while some are synergistic and others are antagonistic to one another. There is also similarity in the action of pituitary growth hormones and androgenic hormones. Embryological considerations help explain some of these points. Certain metabolic alterations result when the average normal balance of these hormones is disturbed. Such imbalances are present in acromegaly, gigantism, dwarfism, eunuchism, eunuchoidism, early or late development of puberty, Cushing's syndrome, adreno-genital syndrome, Addison's disease and Simmond's disease. Cases of some of these abnormalities were presented by slides, and the inter-relationship of the abnormal processes discussed.

Transperitoneal Lavage in Acute Uremia

HERBERT R. BROWN, JR., M.D.: The term uremia has long been synonymous in medicine with the terminal phase of a disease process whether the affliction be acute or of long standing. By no means is this paper an attempt to minimize the serious prognosis attendant with azotemia, but on the other hand the condition may not be entirely hopeless. Recent developments and considerations may accordingly be used in effecting a complete recovery from the acute process, and possibly add years of quite comfortable living to either the acute or chronically involved patient. In the discussion of acute uremia, consideration must be given to pre-renal azotemia, where extra-renal electrolyte imbalance has resulted in the state which may well be confused with the renal type. Simple adjustment of electrolyte balance here effects immediate recovery from the azotemia. In uremia resulting from renal shutdown, regardless of the etiology, kidney decapsulation may be of useful importance, and this procedure will be discussed. Finally, abdominal perfusion with a carefully balanced electrolyte solution may be used with success; accordingly, this technique is presented along with an analysis as to its usefulness, its hazards, and a complete survey of the chemical changes which were effected in the blood, and also the abdominal perfusate of a patient. The case for consideration is a 26 year old female, who was maintained with almost complete anuria by means of abdominal perfusion for a period of 25 days.

Neurological Manifestations in Electric Shock

PAUL H. GARVEY, M.D.: Permanent damage to the nervous system sometimes follows electric shock. Numerous spinal cord and cerebral syndromes have been described in the literature. This report concerns a brief review of the clinical and pathological effects of electric shock in the nervous system. The case of a 55 year old male who came in contact with a 440-volt circuit is also reported in detail. He presented symptoms and signs which superficially, at least, resembled myasthenia gravis. He failed to respond to prostigmin therapy. It is presumed that his neurologic symptoms and signs are on the basis of central nervous system changes caused by electric shock, rather than pathologic physiology at the myoneural junction.

Fungous Infections as a Cause of Dermatitis

HENRY C. SHAW, M.D.: Dermatitis of the hands forms a very large proportion of dermatological practice and is one of the most frequent of compensable illnesses. Primary fungous infections of the hands are not common, although the so-called "ide" reactions on the hands, due to distant primary infections elsewhere on the skin (notably the feet and perineum) are frequently seen. It is thought that these "ide" reactions are due to a hyper-sensitivity to a toxic product of the fungus. The existence of this inflammatory reaction on the hands is a pre-disposing cause for development of hyper-sensitivity to other substances which the patient may be handling, and it is thought to be an important contributing cause for occupational dermatitis. Workers who are exposed to primary irritants and to other possible allergenic substances should be examined for the presence of "ide" lesions and for fungous infections elsewhere, in order to reduce to a mimum the development of occupational dermatitis. In workers who have developed occupational dermatitis of the hands it is necessary to determine the exact etiological agent and to remove the patient from contact with these substances. Patch tests are easily made and are reliable in determining hyper-sensitiveness to external substances.

Tuberculosis in Rochester Medical Students

GORDON M. MEADE, M.D.: Inaugurated in 1937, an intensive tuberculosis case-finding program of quarterly tuberculin tests and chest x-rays detected about five times the amount of disease previously found. Eighty per cent of cases had onset between the middle of second and end of third school year. Incidence rate in students tuberculin negative on entry to school is six times that in those positive on entry. The major increase in the percentage of positive tuberculin reactors was found to be occurring during the second year. This increase in positive reactors has largely been eliminated by prohibiting participation of students in autopsies of persons dying of tuberculosis. There has also been a concomitant decline in incidence rate of tuberculous disease to almost zero following this change. The average interval between tuberculin con-

version and detection of tuberculous disease was found to be seven months. Disease developing following a tuberculin conversion did not conform to the usual concept of primary tuberculosis and was not innocuous.

Tuberculosis Control in Industry: Results 1941-1945

C. A. ALLISON, M.D.: This report concerns our experience with the development of active pulmonary tuberculosis among employees of two divisions of The Eastman Kodak Company in this city, during the five-year period. The groups under observation increased from 6,000 in 1941 to 10,000 in 1945. The applicants employed for varying periods of time totalled 20,500. Eighteen cases appeared among a total of 26,500 people. The attack rate closely paralleled age distribution. Eight of 15 had minimal tuberculosis, considered inactive, at time of employment, as have 2% of all employees. Fifteen of 18 were minimal when discovered active. One only had what could be considered specific symptoms; 10 were asymptomatic. In the majority the active lesion was infraclavicular; it was also seen to develop apically, and in chests considered to have only apical caps. Active tuberculosis was seen in from less than a year, to over 23 years, after employment. Half of the group were treated at home by family physician. In only one has the disease so far been progressive. Eleven returned to work in from three to 18 months. Single 14 in. x 17 in. chest plates are taken at time of employment, and routinely every one to five years thereafter; every five years only, in employees over 35; in the presence of suggestive symptoms, and after prolonged absence for any reason.

B.C.G. Vaccine in Prophylaxis of Tuberculosis

RALPH J. JACOX, M.D.: Renewed interest in the use of B.C.G. vaccine, made from an attenuated, avirulent strain of bovine tubercle bacilli, has reopened the question of its value and safety. It has been completely established in the minds of most tuberculosis specialists that this vaccine, made under standardized conditions, is harmless. Over three million infants have been vaccinated without any proved case of death resulting from the administration of B.C.G. Recent studies indicate that statistically there is definite protection afforded by the vaccine when it is administered to tuberculin negative individuals. Indications for the use of the vaccine seem to be: (1) Tuberculin negative infants and children exposed to tuberculous environment. (2) Nurses, medical students and other personnel found to be tuberculin negative, who have frequent exposure to tuberculous patients or laboratory infection. (3) Tuberculin negative individuals existing under adverse economic conditions and exposed by environment to tuberculous infection. Data were presented to delineate the effectiveness of the vaccine as studied by numerous workers. Methods of administration and standardized procedure of vaccine production were briefly described. It is clearly understood that B.C.G. vaccine will never be a substitute for rigid preventive measures for tuberculosis and will be merely an adjunct in tuberculosis control.

The Diagnosis of Neurosis

JOHN ROMANO, M.D., Professor of Psychiatry, University of Rochester Psychiatrist-in-Chief, Strong Memorial Hospital: The accurate diagnosis of neurotic illness, like the accurate diagnosis of any type of illness, is dependent upon the physician's ability to obtain data which establish significant correlations between cause, effect, course and treatment. Unfortunately, in many instances, attempts are made to diagnose neurotic behavior on the basis of negative data, i.e., through the exclusion of demonstrable structural disease. Of the methods needed to obtain positive data in the diagnosis of neurotic illness, the intelligent use of the interview is the most important. Positive data are obtained through acquiring information about the onset and setting of the illness, the precipitating factor, the presence or absence of emotional conflict, the nature of the symptoms, the appropriateness of symptoms to demonstrable structural disturbances, the specific determinants of symptoms, and the age, personality structure, past life experiences, sexual adjustment, previous neurotic symptoms and the behavior of the patient during the interview. Frequently it may be impossible to obtain all the data, but knowledge of method and goal will enable the physician to be more accurate in his diagnosis.

Left to right: DR. WILLIAM J. FULTON, Medical Director, General Motors, Detroit; DR. EDGAR BOLING, B.O.P., Atlanta, Georgia; DR. ERNEST WOLFF, Fisher Body Division, Detroit; DR. R. S. VAN HORN, Diesel Equipment, Grand Rapids, Michigan; DR. CARL HANNA, Fisher Body, Baltimore; DR. MELVIN L. HOLE, Saginaw Steering, Danville, Illinois; and DR. A. W. HUDSON, Chevrolet Gear & Axle, Detroit. The guide (Rochester Products Division) is explaining an operation during a group tour of the plant

Problems Concerning the Autonomic Nervous System

W. J. MERLE SCOTT, M.D.: *Vasospasm*: Arteriospasm in attacks or continuously may occur in (A) Raynaud's disease, (B) post-traumatic, and (C) in occlusive arterial disease. Clinical methods of its pre-operative determination are outlined and treatment discussed. *Hypertension*: Factors influencing the choice of cases of hypertension for treatment by thoraco-lumbar sympathectomy are outlined and the results obtained are discussed. *Pain*: Under certain conditions, visceral and post-traumatic pain may be controlled or alleviated by sympathetic denervation of the area. This is discussed for causalgia, painful osteoporosis and pelvic pain. *Duodenal ulcer*: The rationale of vagotomy in the treatment of duodenal ulcer is discussed and results to be expected are illustrated. Advantages and disadvantages of the method are considered.

The Problem of Cancer of the Breast

SAMUEL J. STABINS, M.D.: Cancer of the breast is a problem which concerns the physician, the surgeon and the radiologist alike. It concerns the physician primarily, for it is a disease that requires no special training, no unusual instruments for diagnostic purposes but, on the contrary, a close relationship between the physician and his patient. In 1903 the death rate from cancer of the breast was 5.5 per 100,000 population—in 1944 it was 15 per 100,000 of the population. The annual incidence in New York State in 1944 was 60 per 100,000 of the population, placing it at the top of the list of malignancy. The incidence of carcinoma of the breast is much higher in single women than in married women over 35 years of age. The relationship of nursing in the prevention and castration in the treatment are factors of more than passing interest. The estrogenic effect on mammary growth is taking on increasingly added significance. If cancer of the breast is to be recognized, early education is of the utmost significance, for it is the patient herself, who is in the best position to recognize the abnormality. The interval between recognition of a lump in the breast and its actual removal is still far too long. The value of x-ray therapy pre-operatively, has been generally discredited and likewise discarded. The use of x-ray therapy post-operatively either in the absence or presence of axillary involvement is open to question. Radiation therapy is used in cases with metastatic

Left to right: MR. BOB BURNHAM, workman, Rochester Products; DR. MARTIN I. HALL, New Departure Division, Bristol, Connecticut; DR. C. A. LEATHERMAN, Delco Remy, Muncie, Indiana; MR. FRANK A. PATTY, Industrial Hygiene Consultant, Detroit; DR. A. H. SEIPLE, Packard Electric, Warren, Ohio; DR. W. D. TILLSON, Electro Motive Division, La Grange, Illinois, watching machine operation equipped with partial hood and exhaust ventilation at Rochester Products Division

bone lesions purely as a palliative procedure. Irradiation of the ovaries for metastasis is an accepted procedure, but it is questionable whether its effect is as certain or as effective as bilateral oophorectomy. Radical mastectomy is the only preferred method of treatment, but unfortunately, too many cases are seen at a stage in the disease where even this procedure holds out little hope. Primary skin grafting, following radical mastectomy has no influence on the occurrence of swelling of the arm, but wisely used, is of value in improving the function of the arm by leaving the wound open, thus avoiding tension and contracture of the axilla. Swelling of the arm does not signify recurrence of the carcinoma. Androgen therapy in advanced carcinoma of the breast has failed to produce any striking benefits. In the absence of a more specific therapy our present energy should be directed towards prevention and early diagnosis for the best results have been obtained in patients in whom the disease was local and in whom radical mastectomy had been performed.

Experience in Secondary Closure of Wounds

T. B. JONES, M.D.: In anticipation of D Day with the inevitable influx of large numbers of wounded, a routine for the treatment of wounds was adopted. Emphasis was placed on the application of sound fundamental surgical principles with a minimum of chemotherapy. Unfortunately laboratory facilities were inadequate for satisfactory bacteriologic studies in the entire group of 700 patients, but early studies on a few wounds showed a mixed flora. On admission to the hospital, all chemotherapy and antibiotics were discontinued. Wounds were mechanically cleansed by removing coagulated blood and serum by moist saline dressings and secondary debridement where necessary. It was found that there was no optimum time for performing secondary closures, which were decided upon the basis of clinical examination of the wounds. The time interval varied from three to 28 days. In no instance were chemotherapeutic drugs applied locally to the wounds at the time of closure, the patient being fortified by sulfadiazine given orally beginning 48 hours before closure and continued for three to five days postoperatively. Closures were accomplished by excision of all exposed surfaces (including granulating areas) and suturing in layers with silk sutures, no drainage being used. Defects too large for closure by suturing alone were closed by a combination of suturing and grafting. Absolute hemostasis was the primary requisite. Because of the large volume of work and the variation of individual staff members in their clinical critique, results were judged on the basis of the condition of the wounds at the end of 14 to 16 days, a satisfactory result being one in which the wound was healed and required no dressing or further surgical care at the end of this period. Upon this basis 68% healed by what could be considered primary healing; 26% healed by "moist healing" but were dry with slight crusting; and 4% broke down. In the latter group the presence of a foreign body or insufficient debridement was inevitably the cause. A group of 50 cases in which sulfa drugs were applied locally exhibited more marked local reaction, and all fell into the group of moist healing, exhibiting marked weeping and exudation between the sutures. The observations on this group of 700 wounds seem to indicate that (1) there is no substitute for good surgical technique in the care of wounds, and (2) systemic administration of chemotherapeutic drugs provided adequate protection against infection, and wounds healed with a minimum of local reaction.

Struma Lymphomatosa, Struma Fibrosa and Thyroiditis

J. A. SCHILLING, M.D.: Riedel first described a diffuse fibrosis of the thyroid in 1896. In 1904 De Quervain first described a giant cell type of thyroiditis. In 1912 Hashimoto described a diffuse struma lymphomatosa. Since these original descriptions there has been much confusion of case reports, though at present struma lymphomatosa is considered by most a clinico-pathologic entity, despite the weight of Ewing's opinion to the contrary. Struma fibrosa and its giant cell variant have been confused in the literature, and no attempts have been made to present their relationships. The etiology of struma lymphomatosa is unknown, though it is considered a degenerative disease in contradistinction to a neoplastic or inflammatory disease. Struma fibrosa and its giant cell variant are considered two late manifestations of the thyroid from an acute to chronic inflammatory process. The pathology, gross and microscopic, was discussed in detail. The important differential diagnosis is from malignant growth. Treatment of struma lymphomatosa by radiotherapy after preliminary biopsy is quite effective. Treatment of struma fibrosa is largely surgical and should be as conservative as possible because of the risk of damage to recurrent laryngeal nerves or parathyroids. The end result of treatment, barring surgical complications, is generally good, though with struma lymphomatosa there is a progressive tendency to myxedema.

Cartilagenous Tumors of Bone

G. BURROUGHS MIDER, M.D.: The principal difficulty that confronts clinicians who treat cartilagenous tumors of bone is distinguishing benign from malignant forms. Three types of cartilagenous neoplasms may be recognized. Chondromas are readily cured by relatively conservative surgical procedures. Chondrosarcomas are bulky, rather slowly growing neoplasms which recur repeatedly after local excision or curettage. Those composed entirely of cartilage or myxomatous tissue may persist for years before metastasizing. Chondrosarcomas that contain areas of anaplastic spindle-shaped or pleomorphic cells metastasize early and simulate true osteogenic sarcoma. Probably these types are inter-related. The clinical and pathological characteristics of cartilagenous tumors of bone were discussed.

Cartilage Grafts

FORREST YOUNG, M.D.: As in all tissue grafts there are three separate types of cartilage grafts which can theoretically be used. These are heterogenous grafts, such as beef cartilage; homogenous grafts, that is from one human to another; and autogenous grafts, from one part of the body to another. In addition, preserved cadaver grafts have been used but these should not properly be called grafts as they are dead and inert and are no more than foreign bodies. It is the general opinion that only autogenous grafts act as true grafts and will live. Heterogenous grafts are never used. Homogenous grafts were used for a time, particularly in ear reconstructions, but these have been discarded since it has been found that they absorb with time. The cadaver grafts have the same objection. We have found that it is possible to cut cartilage

in various forms. This can be done in two different ways. In the first, the cartilage is cut in forms, inserted in the area, and a latex form applied externally; thus areas such as the malar eminence can be rebuilt to almost perfect contour. One can also place finely chopped cartilage in an inert, perforated metallic form and bury it in the subcutaneous tissues for a period of some months. The cartilage particles are held together by the surrounding tissues and in this manner can produce an artificial fibrous cartilage of complicated form. We have used this to produce cartilage forms in the reconstruction of ears.

Dysmenorrhea

WESLEY T. POMMERENKE, M.D.: Dysmenorrhea continues to be one of the more prevalent and difficult gynecological problems largely because it is frequently found to exist without previous demonstrable disease or deformity. Considered as a symptom it is usually due to a combination of causes either local or general, or both. Not uncommonly it is of psychic origin arising from faulty training or notions in matters relating to sexual or reproductive phenomena. Dysmenorrhea may result from hormone imbalance, and will, in selected cases, respond to endocrine therapy. It may have an organic basis, and be secondary to pelvic congestion or inflammation. New growths in the pelvis may be responsible. Of special interest is that form of acquired dysmenorrhea due to misplaced endometrium in endometriosis. It is the job of the physician to determine the cause of dysmenorrhea in each particular case. An educational program may be effective in correcting misinformation concerning the physiological nature of menstruation. In recent years there has been a fortunate tendency toward treating dysmenorrhea more conservatively. However, new surgical techniques of a non-destructive nature offer relief in selected obstinate cases.

Hematuria

W. W. SCOTT, M.D.: Hematuria, whether it be gross or microscopic, should be considered a sign of a very serious pathological lesion of the genito-urinary tract until proved otherwise. Even many of these serious lesions, in their early stages, respond satisfactorily to proper treatment. Therefore it is our duty, as physicians, to determine the source and cause of hematuria and extend proper treatment as soon as possible. It is our purpose to present this subject with special reference to the diagnostic factors that are of interest and use to the physician who is not specializing in genito-urology. Special emphasis will be placed on the diagnosis and treatment of some of the more common and serious lesions of the genito-urinary tract that cause hematuria.

Sprained Ankles

LOUIS A. GOLDSTEIN, M.D.: A simple "ankle sprain" may mask a rupture of the lateral ligament components of the ankle joint. This is a serious lesion. If it is not recognized and not adequately treated a permanently weak ankle may be the result. The usual mobilizing regime for the treatment of sprained ankle is not good treatment for a complete tear of the lateral ligaments of the ankle joint. Particularly contra-indicated is the treatment of severe "ankle sprains" by local novocaine injection and early unprotected weight-bearing. Prolonged immobilization is required for treating of the ligament structures. The diagnosis of lateral ligament tear may be suspected on clinical examination but can be definitely established only by roentgenographic examination of the ankle joint under stress. Anatomical studies, observation on postmortem specimens and clinical cases are presented. Diagnosis and treatment were discussed.

The Quantitative Definition of Human Locomotion

R. PLATO SCHWARTZ, M.D.: The normal use of the lower extremities to fetch things is essential for the expression of human efficiency. Any significant limitation in the function of walking is an index of a corresponding degree of disability. Such limitations, particularly if accompanied by pain, are regarded as a potential liability to industry. To the orthopedic surgeon they present a problem of evaluation as to cause, treatment, and the end-result. But, in the broader aspects of the relationships of the employee to his work, we want to know how to prevent such disabilities from occurring in the wake of particular types of work. There is a prevailing awareness of limitations which have prevented the fulfillment of these objectives up to the present time. Chief among these is the fact that we have had no quantitative basis for defining the normal pattern of human locomotion. Likewise it has not been possible to define disabilities except by description. For the same reason the evaluation of end results and methods of treatment have rested on individual memory of the functional disability which prevailed prior to the beginning of treatment. As a result of work in progress since 1926, resources have been developed for recording human locomotion through six areas of the plantar surface of each foot during the act of walking. From these records the stance phase of normal locomotion has been quantitatively expressed in a single curve. Likewise disabilities have been evaluated in single curves for comparison with the established norm. We now have some of the essential tools with which to acquire information as needed for the purposes above stated.

Intravenous Urography for Screening Patients

JOHN A. BENJAMIN, M.D., and VERNON L. BOLTON, M.D.: Technical procedures and clinical aspects were discussed in this report, and x-ray films were shown to demonstrate the points under consideration. In addition, it was emphasized that this type of study realizes the maximum benefits when the efforts of the roentgenologist and the urologist are combined. Intravenous urography has proved to be a means whereby questionable renal pathology can be excluded, or, if changes are observed, then further instrumental studies and x-rays are indicated. It provides a means by which one can detect congenital malformations, tumors, infections, traumatic injuries (even in cases of mild shock), and, in certain instances, one may gain some information as to renal function. The procedure is relatively simple, can be conducted in the office or hospital, and carries a very small percentage of minor reactions.

Roentgen Therapy of the Painful Shoulder

MURRAY P. GEORGE, M.D.: In most cases of tendogenetic disease, roentgen therapy will alleviate the symptomatology of the painful shoulder. Best results are obtained in the acute "bursitis" with the typical symptoms of point tenderness over the bursa, pain radiating in the distribution of the brachial plexus, i.e., down the arm to the fingers, up the neck, and marked limitation of motion. About six hours following the first roentgen treatment the pain may be aggravated, to improve gradually in 24 to 48 hours. By the third treatment the patient is usually asymptomatic, but with some moderate limitation of motion. The more chronic case responds to treatment much more slowly, with the maximum response occurring, in some instances, one month following the completion of the course of treatment. The treatment consists of 200 r in air at weekly intervals, alternating anterior and posterior ports until 400 r in air has been delivered at each port. The patient is warned not to apply heat or irritants to the local area during the course of treatment. If the chronic case does not respond within one month following the course of treatment, a second course may be considered.

Myelography with Pantopaque

PROFESSOR GEORGE H. S. RAMSEY, The University of Rochester, Strong Memorial Hospital, Rochester: Pantopaque is an oil-type liquid contrast medium of low viscosity which was developed especially for myelography. The results of several years of clinical experience with the new medium show that: (1) Pantopaque is easily injected and removed from the subarachnoid space; (2) during fluoroscopy the medium may be readily passed repeatedly over an area with a suspected defect; (3) the low viscosity permits visualization of the auxiliary nerve pouches and study of minimal defects; (4) using Pantopaque allows an examina-

tion to be completed in 15 to 20 minutes; and (5) the rate of disappearance of residues left in the subarachnoid space indicates that about 1 cc. of the medium is absorbed per year. These features were illustrated by a number of typical cases taken from a series of 300 myelograms.

Non-Disabling Bronchiectasis

THEODORE B. STEINHAUSEN, M.D., Associate Resident in Department of Radiology, Strong Memorial Hospital, Rochester, New York (From an article by ARCHIE FINE, M.D., Cincinnati, and THEODORE B. STEINHAUSEN, M.D., Rochester, appearing in *Radiology*, 46, p. 237, March, 1946): The purpose of this paper is to point out that the diagnosis of bronchiectasis does not always indicate a chronically ill patient with severe cough, abundant sputum, and hemoptysis, but to direct attention to a group of individuals with few symptoms or none at all, who are able to perform rigorous work. This is the early and relatively non-symptomatic phase of bronchiectasis. It is during this stage of the disease when close follow-up with adequate medical and surgical care saves an apparently healthy individual from the invalidism of advanced bronchiectasis. The report reviews the finding on a group of 41 cases found in a routine photo-roentgen survey of 156,000 prospective air cadets, most of whom had previous chest films. In the majority of cases, the roentgenographic changes were so slight that unless one is particularly on the look out for minimal changes and follows them for a period of weeks, the diagnosis is easily overlooked. Eight exemplary cases were presented with films and case histories on four.

Personnel Practices in Fifteen Countries

DEAR CHARLIE"—letters of comment on personnel practices in 15 countries—is written by BERT HANMAN, of Berkeley, California, personnel researcher, who is being sponsored by the Rheem Manufacturing Company to prepare a book on "The Worker and His Job" for the general good of industry, government and labor. These letters will appear each month for the next six months in INDUSTRIAL MEDICINE, *National Safety News and Personnel Digest* in America, as well as in several European journals.

New York, September 18, 1946.

DEAR CHARLIE, tomorrow morning I leave New York for London by air. Ahead lie better than four busy months in 12 European countries—England, Ireland, Norway, Sweden, Denmark, Holland, Belgium, France, Switzerland, Italy, Germany (probably) and Russia (possibly).

What will I be able to find out about "The Worker and His Job?" What is happening in the fields of industrial medicine and hygiene, industrial psychology and psychiatry, industrial engineering and safety, and industrial training and education? What is being done in rehabilitating and utilizing disabled workers? How well are the universities geared to these problems? These questions, Charlie, are some I wish to investigate.

During the past five weeks since leaving home in Berkeley, California, I have been traveling in the United States attempting to get the picture of American industry before going to Europe. I have "covered" several of our important areas—San Francisco, Los Angeles, Chicago, Detroit, Pittsburgh, Washington, Philadelphia, New York and Boston, reaching out to other areas by long distance telephone. I have contacted close to 150 people concerned with personnel work—industrial physicians, psychologists, psychiatrists, engineers and educators—and have visited many plants, hospitals, agencies and organizations. In Europe, I want to be able to "give" as well as "receive," to tell them about American personnel practices and to learn about their methods.

"The Worker and His Job" is to be the title of the book for which I am gathering material. I hope to have the manuscript completed in about one year from now, which means that I should be able to place the published book in your hands sometime in 1948. Charlie, it is bound to be a success (ahem!) and here are the reasons:

In every country I have excellent contacts. Everyone has been wonderful in giving me introductions. Well, in each of the 12 European countries (and in America, Canada and Mexico on this continent) I am going to try to get an outstanding person to prepare a 2000-word introduction to the chapter on his country. These introductions will vary, in one instance being by an industrial physician, in another by an industrial psychologist, engineer, educator, etc. My good friend, DR. HENRY H. KESSLER, has agreed to introduce the chapter on the United States. I am also planning to have a master introduction of about 5000 words and am hoping that DR. RICHARD SCHILLING, Secretary of the Industrial Division, Medical Research Council of Great Britain, will furnish this material. Could anyone be better!

In addition to these introductions by eminent people of the world, I am planning to include many photographs of persons, plants, processes, and products—not a "Who's Who," but rather people whom I actually meet, become acquainted with, and about whose work I know—plants that I actually visit and feel qualified to discuss.

The material I will prepare for the book will be rather dry, I suppose, consisting of the presentation and discussion of methods and procedures in the many phases of personnel work. In other words, Charlie, the book will be a kind of cross-breed between *Life Magazine* and *The Journal of the American Medical Association* with the hope that one extreme will relieve the monotony of the other.

While gathering material for my book in America, the idea occurred to me that when I get to Europe I should not just leave my card with the various people I contact and request material be sent to me alone, but rather leave a list of the many people in America who I know would be interested in receiving material related to this field of interest. Therefore, I am preparing a list of some 200 friends in America and will give this list to people throughout Europe. Then, upon completing my work in Europe, I will have developed a list of European contacts and when I return to the United States I shall leave the European list with my American friends for the purpose of reciprocating by sending materials abroad. It seems like a fair idea to stimulate thought, really costing no one anything.

And here is another idea I hope you will like. I suppose it stems from my respect for medical people, believing as I do that as a professional group they are superior, that they are basically honest and gracious. The idea is to function for them in working out an exchange of American editors with editors of foreign journals, primarily for our two journals, INDUSTRIAL MEDICINE and *Occupational Medicine*. In brief, our editors would appear as associate editors of foreign journals, and their editors would appear as associate editors of our journals. Furthermore, to give this idea substance more than just an exchange of names, both our journals and the European journals would agree to reprint at least one of the other's better articles each issue. It seems to me that this simple plan should go a long way to dilute the thought that we in America are more or less sufficient to ourselves, and should do a good deal to broaden our international interests and outlook.

I have discussed this plan for a foreign exchange of editors and articles with most of the members of the AMA Council on Industrial Health and they have all appeared enthusiastic. I feel honored in receiving their endorsement to perform this service for them, and it will be a real source of pleasure to me to help bring about this exchange.

In speaking with the members of the AMA Council on Industrial Health, I have had fun also in twitting them with the fact that they do not have a Western representative as a member of their Council (of course, by "Western" it should be clear enough that I mean from California). It seems to me that as a Council of industrial physicians representing America,

greater credit would be reflected should not all their members be concentrated on the East Coast. As you know, we have the men in the West who would do any such Council credit. Let's look forward to the day when the West is represented!

Five weeks ago, when I started out on this trip with the knowledge that DR. RICHARD SCHILLING, of London, had prepared a marvelous itinerary for me in England, I was particularly concerned to uncover information in America which would help me to "talk against" the English law which requires employers to hire 20% disabled workers. The theory behind being "against" this law, as you know, involves the principles that it is not "good" to segregate disabled workers from other workers, and that by having a compulsory law to employ 20% disabled there are certain to be "poor" disabled workers included, thus tending to reflect discredit on the disabled as a whole. I was hoping to find in America (where no such law exists, although a similar law is being considered at the present time) that our industries would be utilizing a reasonably high percentage of disabled workers. I am very disappointed to find that this is not the case, some of our large industries having less than 1%, rarely 10%, but, in one instance, better than 25%. Of course, it should be made clear that there is a great difference in the interpretation of what constitutes a physically handicapped worker, and thus our percentages reflect these differences of understanding. Of all the studies which have been made to prove that disabled workers are as good as, if not better than other workers in connection with production records, absenteeism, sickness, accidents, turnover, etc., one would think logically that employers would welcome disabled workers, particularly since making their many statements during the war about the value of the disabled and also because of policies to utilize especially disabled veterans. But the war is over and again it appears to me that employers' voices are swelling the old refrain that "we care for our own disabled and will accept our own disabled veterans back and that fulfills our responsibility." So, I am now bewildered, Charlie, and am beginning to wonder whether the British system may not be better after all, regardless of "theory and principles." In this connection, however, one can indeed praise our Insurance Interests who have done and are doing admirable work in offering services and recommending ways and means for the safe and successful placement and utilization of disabled personnel.

I would like to make one brief comment on what I consider to be the outstanding need in America to improve the problems of the worker and his job. This need is for professionally qualified personnel folk, people professionally trained to understand and coordinate the efforts of industrial phychologists, psychiatrists, physicians, engineers and educators. More power to the schools which are working toward the fulfillment of this need, such as Ohio State University and the Harvard Graduate School of Business Administration!

Then there is another problem, Charlie, one that I hope to help work on in the future. In a nut shell, I would like to mention the research plans I have in mind upon completing the manuscript on "The Worker and His Job." These future plans are centered around my belief that industry has not fully discovered that the worker is a human being with 24-hour-a-day problems. It appears that we now look upon the worker as an eight-hour mechanism. Our concern has been primarily with the man of skills, experience, intelligence, education, interest and aptitudes. In a secondary sense are we becoming aware of the physiological characteristics of the worker—his physiological and environmental capacities for work in addition to his skill characteristics mentioned above. However, there remains the emotional man to consider, probably the most important group of characteristics in the success and happiness of the worker and hence of the employer.

In my future research plans I hope to be able to investigate the 24-hour problems of the worker, his skill, physiological and emotional characteristics. My approach will be to attempt to extend the techniques of job analysis to cover the 24-hour-day—the working environment, domestic environment, social, sexual, intellectual and recreational environment of the worker. While I will never be able to accomplish this task in my lifetime, I may be able to formulate some of the problems involved and stimulate further researches. The idea would be that if a standardized pattern could be developed for analyzing the 24-hour environment, this pattern could then be applied in situations where the worker or patient was suffering from emotional disturbances.

Perhaps I can illustrate this idea better by this example: Let us suppose that you are a patient in a mental hospital and about ready to be released for parole. With the technique I have in mind, the psychiatric social worker would be able to analyze the 24-hour environment to which you were to return. Then, the psychiatrist, using the same pattern of 24-hour environmental factors, would be able to translate his findings in your case into the type of environment that you should have and could tolerate. The psychiatric social worker, then, having this type of report from the psychiatrist (rather than just the diagnosis), would then be able to make comparisons between the environment recommended by the psychiatrist and the actual environment to which you were to return. Discrepancies could be detected readily and the psychiatric social worker would be placed in a better position to go about making adjustments and helping you to return to a healthy life. Anyway, Charlie, I am burning to see what I can do in connection with the problems of the emotional man. The work dovetails since the emotional man is also a man of skill and physiological capacities—the "whole man" with skill, physiological and emotional characteristics pictured on the basis of the 24-hour day.

I deeply regret that I am not able at this time to give detailed comments on the many delightful and stimulating interviews I have had with the 150 people who have been so friendly and kind to me during my preliminary investigations in America. When I return from Europe, I am planning to see all these people again, having been invited to speak in the various areas I have visited. At least I should be able to tell a French story or two! When I return, I plan to travel also in Canada and Mexico to complete the date for "The Worker and His Job" in 15 countries of the world.

But right now I feel the "nearness" of Europe, and my heart beats faster with the hope that I will be able to fulfill my responsibilities. Certainly, I am deeply appreciative and most thankful for the opportunities that have come my way. Let's hope that in some way my efforts will be able to better the worker and his job.

So, until my next letter from England, goodbye. . . .

—BERT HANMAN.

LETTERS

TO THE EDITOR:

IN DR. LEGGE'S excellent article on Ramazzini in the August, 1946, number of INDUSTRIAL MEDICINE, there are two points in which the author differs from most authorities who have written on this subject.

The first variation is in the spelling of Ramazzini's first name. Ordinarily, the name is given as Bernardino rather than Bernardini; I wonder if one of these is correct or whether both are acceptable. The second difference has to do with Ramazzini's place of birth. Most authorities state that Ramazzini was born in Carpi which is in Modena in northern Italy. As we all know, Capri, the town given in Dr. Legge's article as Ramazzini's birthplace, is a small island near Naples in southern Italy.

Perhaps these comments are suggestive of "hair splitting," however, those of us who are interested in medical history tend to become slightly fussy over names, dates and places. My remarks are not to be construed as a criticism of DR. LEGGE'S article which I consider to be a very fine piece of work.

—LEONARD J. GOLDWATER, M.D.,
Professor of Industrial Hygiene,
Columbia University School of
Public Health.

Placing the Handicapped

—A Positive, Individual and Specific Approach—

BERT HANMAN,
Personnel Research,
Berkeley, California

CAN YOU do the heavy lifting required of stevedores? Do you have the perfect vision required of pilots? Can you stand and walk all day as a counter clerk? If not, you are physically limited in the eyes of industry.

Any worker who does not possess the physical capacities to meet the physical demands of the most arduous job is physically limited to the degree that his capacities fall short of meeting the most arduous demands.

Many of us, therefore, are not supermen physically. Many of us are physically limited—millions and millions more than anyone cares to admit. Many of us, then, require better placement methods.

It is easy, however, to reduce the problem and limit the number of physically handicapped by stricter definitions: only to those with gross disabilities—only to those whose disabilities present a special problem in placement—only to those disabled who need rehabilitation before employment is possible—only to those whose disabilities make them permanently unemployable.

It is easy, also, to confuse the issue with the common assertion that "a physically handicapped worker is no longer physically handicapped when he can fulfill the requirements of a suitable job." Statements to this effect are responsible for considerable bewilderment as to who is and who is not physically handicapped. The terms "physically handicapped," "physically impaired," "physically restricted," "physically limited" and "physically disabled" may be used synonymously and in personnel work refer to workers with reduced physical capacities. These terms, however, are confused frequently with the term "occupationally (or vocationally) handicapped." Occupations have numerous requirements—skill, experience, intelligence, educational, aptitude, interest, personality, emotional, physical and environmental requirements. *Everyone is occupationally handicapped for all the jobs in which he can not meet all these requirements.* When a physically handicapped worker, then, can satisfy all the requirements of a job, he is not *occupationally handicapped* for that job. He remains, nevertheless, *physically handicapped.* A successful blind worker, for instance, remains blind. A capable physically handicapped worker, therefore, *is* physically handicapped but *is not* occupationally handicapped for the job in which he is successful. The misleading assertion should be corrected to read: "A physically handicapped worker is no longer occupationally handicapped when he can fulfill the requirements of a suitable job."

But, regardless of possible confusion as to who is or is not physically handicapped, and regardless of selected definitions, the problem of placing workers according to their abilities is sizeable. If workers are to be placed successfully and safely, then their physical capacities must be evaluated as accurately as their skills, intelligence and aptitudes are determined through standardized techniques. The total characteristics of the worker must be understood as well as the total characteristics of the job if worker and job are to be matched to the greatest advantage of the worker and the employer.

This article appears simultaneously in INDUSTRIAL MEDICINE, *National Safety News* and *Personnel Digest* in America, as well as in several European professional journals.

In matching the physical characteristics of workers and jobs, many pitfalls may be avoided by using a *positive, individual and specific approach.*[1] In the first instance, the physical abilities of workers should be emphasized,[2] what the worker can do—how much he can lift, climb and stoop, for example. Personnel officers are concerned with a positive picture of the worker's abilities, not with his diagnosis and disabilities. It is the physician's job to translate his negative findings into positive terms, to determine the worker's *physical capacities.*

Likewise, in judging the worker's capacities, the "good" physician will analyze each worker on an individual basis, realizing that there is often wide variation between individuals in any one disability group. The physician will not, for instance, classify all workers with heart disease as having the same physical abilities. While two workers with heart disease may have identical diagnoses, one may be allowed to climb steps intermittently for ½ hour per day and to lift up to 25 pounds for one hour, while the other may have his climbing completely restricted and be allowed to lift only 10 pounds, each case depending on previous work history and the amount of compensation required.

Finally, the physician should avoid subjective terminology when expressing the individual worker's physical capacities and should deal in specific terms. For example, rather than saying that worker can do "moderate" walking, the physician should translate what he means by "moderate" walking into specific terms, such as walking 2, 3, 4, 5 or 6 hours per work period.

Not only should the physical abilities of workers be appraised positively, individually and specifically, but the physical demands of jobs should be analyzed using the same approach. By determining both the *specific, individual requirements of* jobs and the *specific, individual capacities* of workers, then may all workers be placed on those jobs for which they possess the skills and physical qualifications. This article discusses a placement plan using this approach.

Description of Plan

AT FIRST glance, the illustrations of this technique may appear hopelessly complicated. Actually, for a comprehensive plan, it requires a minimum of time, effort and expense to effect and maintain its operation.

The personnel required to effect and operate the plan consists of (1) job analysts, who make the physical demands analyses and prepare the Master Chart, (2) industrial physicians, who determine the workers' physical capacities, and (3) placement officers, who relate the workers' capacities to the job demands. Supervisors, also, play an important role, as well as industrial and safety engineers and counselors. Outside the plant the technique is helpful in developing relationship with trade schools, rehabilitation centers and placement agencies to assure the plant of a source of capable workers.

Physical Demands Analysis Work Sheet—Fig. 1

THE first step in effecting the program is to analyze the physical and environmental demands of the jobs in the plant, usually excluding the administrative, clerical and supervisory occupations. For this purpose the Work Sheet shown in Fig. 1 has been developed. It contains 82 factors, practically all the factors possible to encounter, and is designed for universal use in *any* plant, large or small.

For best results, the jobs should be analyzed by *trained* job analysts. Job analysis work is technical

PHYSICAL DEMANDS ANALYSIS WORK SHEET Job # 30

JOB TITLE: Automotive Mechanic, Parts Department, Shop Representative

JOB LOCATION: Common Services Branch, Building 331 West

ENTER: (a) MINIMUM NUMBER OF HOURS JOB REQUIRES EACH FACTOR DURING WORK PERIOD. (b) DASH WHEN NOT REQUIRED. (c) R WHEN FACTORS 9-5-31 ARE REQUIRED.

PHYSICAL FACTORS

1	1	1-5	LIFTING (POUNDS)— INCLUDES PUSHING AND PULLING EFFORT WHILE STATIONARY
½	2	6-10	
-	3	11-25	
-	4	26-50	
-	5	51-75	
-	6	75+	
½	7	1-5	CARRYING (POUNDS)— INCLUDES PUSHING AND PULLING EFFORT WHILE WALKING
¼	8	6-10	
-	9	11-25	
-	10	26-50	
-	11	51-75	
-	12	75+	
-	13	R	FINGERING
-	14	L	
7	15	R	HANDLING
4	16	L	
½	17	R	REACHING: BELOW SHOULDERS
½	18	L	
-	19	R	REACHING: ABOVE SHOULDERS
-	20	L	
-	21	R	THROWING
-	22	L	
6	23		SITTING
4	24		STANDING
1	25		WALKING
-	26	R	TREADING: WHILE SITTING
-	27	L	
-	28	R	TREADING: WHILE STANDING
-	29	L	
-	30		CLIMBING: LEGS ONLY
-	31		CLIMBING: LEGS AND ARMS
-	32		JUMPING
-	33		RUNNING
3	34		STOOPING
½	35		CROUCHING
-	36		KNEELING
-	37		CRAWLING
-	38		RECLINING
-	39		TWISTING
3	40		RESTING
4	41		TOTAL TIME ON FEET
-	42		OTHER:

FIG. 1.

PHYSICAL FACTORS, CONTINUED

20/40	43	FAR-SNELLEN	SEEING
20/8	44	NEAR-JAEGER	
-	45	COLOR	
-	46	DEPTH	
R	47	HEARING	
R	48	TALKING	
-	49	FEELING	
-	50	SMELLING	
-	51	TASTING	

ENVIRONMENTAL FACTORS

9	52	INSIDE	
-	53	FAIR WEATHER	OUTSIDE
-	54	WET WEATHER	
-	55	HOT: ___ °F	
-	56	COLD: ___ °F	
-	57	SUDDEN TEMPERATURE CHANGES	
-	58	HUMID	
-	59	DRY	
-	60	AIR PRESSURE	
6	61	MOVING OBJECTS	
-	62	HAZARDOUS MACHINERY	
-	63	SHARP TOOLS OR MATERIALS	
1	64	CLUTTERED FLOORS	
1	65	SLIPPERY FLOORS	
-	66	HIGH PLACES	
-	67	ELECTRICAL HAZARDS	
-	68	EXPOSURE TO BURNS	
-	69	EXPLOSIVES	
-	70	RADIANT ENERGY (arcing)	
-	71	POOR LIGHTING	
-	72	POOR VENTILATION	
-	73	TOXIC CONDITIONS (name):	
-	74	WET QUARTERS	
-	75	CLOSE QUARTERS	
-	76	VIBRATION	
-	77	NOISE	
7	78	WORKING WITH OTHERS	
7	79	WORKING AROUND OTHERS	
-	80	WORKING ALONE	
5/D	81	SHIFTS	
-	82	OTHER:	

John Stone — ANALYST'S NAME

Norman Henry — VERIFIED WITH: FOREMAN'S NAME

5-22-45 — DATE

PHYSICAL QUALIFICATIONS REPORT

TO: MEDICAL DEPARTMENT DATE: 4-12-46

FROM: PERSONNEL DEPARTMENT BY: N. A. Orland

IS Arnold K. Styles (APPLICANT'S NAME) PHYSICALLY QUALIFIED

TO MEET THE PHYSICAL DEMANDS OF THE JOBS LISTED BELOW:

JOB NUMBER	YES	NO
25		✓
27		✓
30	✓	

FIG. 3.

4-12-46 — DATE

J. J. O'Brien — EXAMINING PHYSICIAN

Code Letters for Toxic Conditions

A—Acetate butyrate fumes from aircraft dope and thinner.
B—Acetone and lacquer fumes from spray painting.
C—Brass and flux fumes from brazing.
D—Carbon monoxide fumes from gasoline motor exhaust fumes.
E—Carbon tetrachloride.
F—Cement and sand dust.
G—Diesel exhaust fumes.
H—Galvanized iron fumes from burning or welding.
I—Grease cleaning solvents (probably carbon tetrachloride).
J—Hydrochloric acid.
K—Industrial soap.
L—Lead and flux fumes from soldering.
M—Lead fumes from burning or melting lead.
N—Lead fumes from welding painted metal.
O—Paint thinner fumes from brush painting.
P—Sewer gas and sewage.
Q—Sodium hydroxide from metal blueing process.
R—Sulphuric acid.
S—Toluene.

FIG. 4.

PHYSICAL CAPACITIES REPORT

NAME: Arnold K. Styles

BADGE NUMBER: M

SEX: M DATE OF BIRTH: 5-21-18

HEIGHT: 71' WEIGHT: 178

REMARKS: Rheumatic Heart Disease c Mitral Stenosis. Enlarged Right Ventricle. Sinus Rhythm. Compensated. (Diagnosis appears on physician's copy only.)

NOTE: BLANK SPACES = FULL CAPACITY. NUMBERS = HOURS OF PARTIAL CAPACITY. 0 = NO CAPACITY.

DATE: 4-12-46 MEDICAL EXAMINER: J. J. O'Brien M.D.

NOTE: NUMBERS = MAXIMUM HOURS REQUIRED. R = REQUIRED. BLANK SPACES = NOT REQUIRED.

FIG. 2.

MASTER CHART
PHYSICAL AND ENVIRONMENTAL DEMANDS

Column headings — PHYSICAL FACTORS: Lifting (pounds) includes pushing & pulling effort while stationary: 1 (1–5), 2 (6–10), 3 (11–25), 4 (26–50), 5 (51–75), 6 (75+); Carrying (pounds) includes pushing & pulling effort while walking: 7 (1–5), 8 (6–10), 9 (11–25), 10 (26–50), 11 (51–75), 12 (75+); Fingering R 13, L 14; Handling R 15, L 16; Reaching below shoulders R 17, L 18; Reaching above shoulders R 19, L 20; Throwing R 21, L 22; 23 Sitting; 24 Standing; 25 Walking; Treading while sitting R 26, L 27; Treading while standing R 28, L 29; 30 Climbing – legs only; 31 Climbing – legs & arms; 32 Jumping; 33 Running; 34 Stooping; 35 Crouching; 36 Kneeling; 37 Crawling; 38 Reclining; 39 Twisting; 40 Resting; 41 Total time on feet; Seeing: 42 Far – Snellen, 43 Near – Jaeger, 44 Color, 45 Depth; 46 Hearing; 47 Talking; 48 Feeling; 49 Smelling. ENVIRONMENTAL FACTORS: 50 Inside; 51 Outside – fair weather; 52 Outside – wet weather; 53 Hot; 54 Cold; 55 Sudden temperature changes; 56 Moving objects; 57 Hazardous machinery; 58 Sharp tools or materials; 59 Cluttered floors; 60 Slippery floors; 61 High places; 62 Electrical hazards; 63 Exposure to burns; 64 Radiant energy – welding; 65 Toxic conditions (see code – inside front cover); 66 Wet quarters; 67 Close quarters; 68 Vibration; 69 Noise; 70 Working with others; 71 Working around others; 72 Working alone; 73 Shifts.

(Entries in each row are given in the order printed, left to right.)

Job Number	Payroll Title and Branch / Job Title and Location	Physical factors (1–49)	Environmental factors (50–73)	Job Number	
	AIRCRAFT MECHANIC, GENERAL – ASA				AIRCRAFT MECHANIC
1	Accessory Preservation, Method 1 – 431 W	3 2 1 2 1 3 1 5 5 2 2 6 7 3 3 1 8 °4 R R R	9 4 2 6 8 8 93	1	
2	Accessory Preservation, Method 2 – 431 W	4 2 2 2 2 1 1 1 3 2 6 5 3 2 4 6 3 2 1 1 1 8 °4 R R R R	9 4 4 6 4 8 8 93	2	
3	Engine Preservation – 431 W	2 3 2 ½ 2 2 3 2 5 5 3 3 3 3 7 3 5 3 3 1 8 °2 R R R R	9 6 6 4 8 8 93	3	
4	Ordnance – 311 & E	3 3 2 2 1 ½ 1 1 ½ ½ 3 2 7 7 3 3 1 1 6 7 2 ¼ 5 3 2 1 1 8 °8 R R R R	9 2 6 6 3 1 2 6½ 4 4 8 8 93	4	
5	Power Unit Preservation – 431 W	2 3 2 ½ 2 2 3 2 5 5 3 3 3 3 7 3 5 3 3 1 8 °2 R R R R	9 6 6 4 8 8 93	5	
6	Propeller Preservation – 431 W	3 2 2 2 1 ½ 2 1 1 1 ½ ½ 3 2 7 6 3 2 7 8 3 1 1 8 °4 R R R	9 3 2 8 8 93	6	
7				7	
8				8	
9				9	
10	AIRCRAFT MECHANIC, MOTORS – ASA – 311 & E	3 3 1 1 ½ ½ 1 1 ½ 4 3 6 6 3 3 1 1 5 7 1 5 3 2 1 1 8 °8 R R R R	9 2 5 6 3 5 5 6½ 4 4 8 8 93	10	
11				11	
12	AIRCRAFT MECHANIC, ORDNANCE – ASA – 311 & E	3 3 1 1 ½ ½ 1 1 ½ 4 3 6 6 3 3 1 1 5 7 1 5 3 2 1 1 8 °8 R R R R	9 2 5 6 3 5 5 6½ 4 4 8 8 93	12	
13				13	
	AUTOMOTIVE MECHANIC – CSB				AUTOMOTIVE MECHANIC
14	Automotive Mechanic – 411	5 3 3 2 2 1 3 2 2 1 2 2 7 7 4 3 3 2 2 6 3 2 ¼ ½ 4 4 2 ¼ 3 3 2 8 8/10 °4 R R R R R	9 8 8 4 5 6 5 5 3 3 3 3 3 5 6 8 8 8 93/50	14	
15	Bicycle Shop – 411 W	4 2 1 1 ½ ½ 2 1 ¼ ¼ ¼ 1 ½ 7 7 2 2 2 7 2 ½ ½ 3 2 1 1 2 8 °4 R R R R	9 8 3 1 4 1 1 1 1 1 4 8 93	15	
16	Body and Fender – 411	5 2 4 1 3 1 2 1 2 ½ ¼ 7 7 4 3 4 3 1 6 2 1 ¼ ¼ 4 4 4 ½ 3 3 2 7 8/10 °6 R R R R R	9 8 8 4 3 4 8 2 2 3 2 18 3 6 6 8 8 80	16	
17	Boring & Grinding – 331 W	2 1 3 ½ ½ ½ ½ ½ ½ ½ ½ 6 6 3 2 ¼ 2 8 1 2 4 ½ ½ 2 8 °2 R R R R	9 1 6 3 3 8 93	17	
18	Carburetor – 331 W	2 ½ ¼ ½ 4 4 6 6 ½ ½ 7 3 1 2 1 1 °4 R R R	9 1 1 2 21 2 9 93/850	18	
19	Clutch and Brake – 331 W	3 3 1 ½ ¼ ¼ ½ ½ ½ 2 1 6 6 1 1 8 1 1 4 1 ½ 1 9 °10 R R R R	9 1 4 4 4 1 1 8 93	19	
20	Electric, Disassembling & Assembling – 331 W	5 2 1 1 ½ ¼ 2 1 ½ ¼ 1 1 7 7 3 2 2 1 1 7 2 ½ ¼ ½ ¼ ¼ 4 4 3 ¼ 3 2 1 9 8/10 °10 R R R R R	9 6 1 5 8 7 2 3 1 2 1 3 8 8 93/850	20	
21	Electric, Minor Repairs – 331 W	5 2 1 1 ½ ¼ 2 1 ½ ¼ 1 1 7 7 3 2 2 1 1 7 2 ½ ¼ ½ ¼ ¼ 4 4 3 ¼ 3 2 1 9 8/10 °10 R R R R R	9 6 1 5 8 7 2 3 1 2 1 3 8 8 93/850	21	
22	Gasoline, Disassembling & Assembling – 331 W	5 2 1 1 ½ ¼ 2 1 ½ ¼ 1 1 7 7 3 2 2 1 1 7 2 ½ ¼ ½ ¼ ¼ 4 4 3 ¼ 3 2 1 9 8/10 °10 R R R R R	9 6 1 5 8 7 2 3 1 2 1 3 8 8 93/850	22	
23	Gasoline, Minor Repairs – 331 W	5 2 1 1 ½ ¼ 2 1 ½ ¼ 1 1 7 7 3 2 2 1 1 7 2 ½ ¼ ½ ¼ ¼ 4 4 3 ¼ 3 2 1 9 8/10 °10 R R R R R	9 6 1 5 8 7 2 3 1 2 1 3 8 8 93/850	23	
24	Gas Station Attendant – 411	1 2 ½ ¼ 1 1 ½ ¼ 7 5 3 2 1 ½ 1 6 2 1 ¼ ½ 4 2 2 3 7 8/10 °10 R R R R	9 7 7 5 1 2 3 2 3 7 985	24	
25	Ignition – 331 W	3 3 1 ½ ½ ½ ½ 3 2 6 6 1 1 3 6 1 4 1 1 7 °4 R R R R	9 ½ 1 3 ½ ½ 21 2 1 1 8 93/850	25	
26	Lubrication – 411	3 2 1 ½ ½ 3 1 ½ ¼ 7 6 4 3 3 2 1 6 3 1 ¼ ½ 4 3 1 ¼ 1 2 3 7 8/10 °10 R R R R	9 3 3 3 6 3 2 3 7 7 93/50	26	
27	Machinist – 411	1 2 2 1 1 1 1 1 ½ ¼ 2 1 6 6 2 1 6 2 ½ 3 2 1 2 8 °7 R R R R R	9 1 8 6 2 2 2 6 8 80	27	
28	Motor Rebuilding – 331 W	4 1 ½ ½ ½ ¼ 1 ½ ¼ 1 ½ 7 7 3 2 8 1 4 1 1 1 9 °8 R R R	9 1 1 1 3 2 21 2 1 4 9 90	28	
29	Parts Department, Inspection & Identification – 331 W	1 2 1 1 ½ ½ ½ 1 ½ 1 ½ 7 7 3 2 2 1 7 3 ¼ 4 1 ½ 2 8 °8 R R R	9 1 1 2 8 8 90	29	
30	Parts Department, Shop Representative – 331 W	1 ½ ½ ¼ 7 4 ½ ½ 6 4 1 3 ½ — 3 4 8/10 °8 R R	9 6 1 1 7 7 90	30	
31	Pump, Radiator & Steering – 331 W	3 2 1 1 ½ 2 1 1 ½ 7 7 3 3 1 7 2 1 3 1 1 9 °4 R R R	9 1 1 4 6 5 1 3 9 93	31	
32	Starters and Generators – 411	4 2 2 3 3 1 1 2 3 2 7 7 4 3 2 1 2 6 3 2 ¼ ½ 4 4 1 ¼ 2 3 2 7 8/10 °4 R R R R R	9 8 8 3 2 5 2 2 3 2 2 2 8 4 80	32	
33	Stock Room – 411	3 2 1 ½ ½ 3 1 ½ ½ ½ 6 5 3 2 2 1 6 5 3 ¼ 2 2 2 ½ 3 7 °8 R R	9 3 2 1 7 7 5 825	33	
34	Tire Repair – 411	3 3 2 2 1 1 3 1 1 ½ 1 1 7 7 3 3 1 1 2 7 3 2 ¼ ½ ½ ¼ ¼ 4 4 3 3 3 7 8/10 °4 R R R	9 7 7 6 3 4 7 5 1 9 2 4 7 7 3 [illegible]	34	
35	Transmission & Differential – 331 W	2 2 3 1 1 ¼ 1 1 1 ½ ¼ 1 ½ 6 6 3 2 7 2 4 3 2 1 1 8 °10 R R R	9 1 3 1 2 8 8 31 3 4 8 93	35	
36	Trouble Shooter – 331 W	1 3 1 ½ ½ 5 5 2 2 1 1 3 5 5 1 1 ½ ½ ½ 4 4 2 1 2 2 2 7 8/10 °4 R R R R R	9 6 3 1 4 3 1 3 60 8 8 93/850	36	
37	Valve Grinding & Pin Fitting – 331 W	1 1 3 ½ ¼ ½ ½ ½ ¼ ¼ 6 6 3 2 ¼ 8 1 2 3 ½ 1 9 °2 R R R R	9 1 6 3 2 1 9 90	37	
38				38	
39				39	
40				40	
41				41	
42				42	
	BLACKSMITH – CSB				BLACKSMITH
43	Blacksmith, Inside – 533 NE	4 5 4 4 2 1 3 2 1 1 7 7 3 2 1 1 8 4 ½ 5 3 2 ½ 1 2 1 9 °10 R R R R	9 9 9 3 2 7 7 4 7 3 2 6 9 9 93	43	
44	Blacksmith, Outside – 533 NE	4 5 4 4 3 1 3 2 1 1 7 7 3 2 1 1 8 4 ½ 5 3 2 ½ 1 2 1 9 °10 R R R R	9 9 9 3 2 7 7 4 7 3 2 6 9 9 93	44	
45				45	
46	BRAKEMAN – CSB – All locations, Office: 730	6 1 4 2 4 7 7 5 5 5 5 7 1 1 ½ ½ 1 2 ½ 5 1 7 8/10 °12 R R R R	8 8 7 1 7 7 2 7 7 [illegible]	46	BRAKEMAN
47				47	
48	CEMENT FINISHER – CSB – 533	5 3 3 2 2 1 7 7 6 6 1 1 2 2 3 3 ½ 3 1 4 ½ 1 3 5 8/10 °4 R R	9 9 2 27 6 7 9 90	48	CEMENT FINISHER
49				49	
	FACTOR NUMBERS	1–49	50–73		

NOTE: NUMBERS = MAXIMUM HOURS REQUIRED. R = REQUIRED. BLANK SPACES = NOT REQUIRED.

and complex, even though the Work Sheet used in this case may imply simplicity. The supposition that supervisors are the obvious source for job information and therefore should make the analyses for their respective jobs, has been shown to be false time and again. This does not mean, however, that supervisors cannot be trained as job analysts nor that job analysts and supervisors should not cooperate in doing job analysis work.

Since it is not the purpose of this article to discuss the technicalities of job analysis work, the completed Work Sheet shown in Fig. 1 is sufficient for illustration. In the boxes opposite the 82 factors is entered the maximum number of hours that any one factor is *required* by the job, allowing for variations in the demands from day to day. A dash is entered for all factors *not required* by the job. (Workers often perform many activities not required by the job. Keen judgment is necessary to be able to distinguish between what the worker does and what the job actually requires.) Near and far visual requirements are determined and entered in boxes 43 and 44.[1] When factors 45-51 are required, R (for required) is entered. When the factors Hot (55) and Cold (56) are required, the temperature is recorded. When the factors Radiant Energy (70) and Toxic Conditions (73) are found, the kind is described on the Work Sheet.

Chart of Physical and Environmental Demands—Fig. 2

WHEN all the jobs in the plant have been analyzed, the Work Sheets are processed and the Master Chart made up as shown in Fig. 2. (Fig. 2 is the first page of a Master Chart of 10 pages.) While the analyst considers the requirements for 82 factors when analyzing each job, the Master Chart is made up of only the factors found to be required in the plant. In this case, 73 of the 82 factors were required by the 317 jobs analyzed.

The jobs are arranged alphabetically and numbered consecutively. Since the analyses should be kept current, a few blank lines are provided after each cluster of jobs for the purpose of writing in future jobs that may be created. An index by payroll title appears on the right to facilitate reference. Since a number of toxic conditions were found in the study represented by this illustration, coding was necessary for this one factor. The Toxic Conditions Code for this study is shown below Fig. 3.

After the Master Chart is completed and reproduced, it is distributed with appropriate explanation to plant physicians, placement officers and supervisors. (Their use of the Master Chart is described further on.) In addition, the Master Chart furnishes industrial and safety engineers with basic information which may be used by them in going about the reduction or elimination of certain physical and environmental requirements and thus making certain jobs less energy consuming and less hazardous. Likewise, counselors may find the data useful in adjusting the worker to his job when physical difficulties are involved. In particular, rehabilitation officers may use the data in determining the direction and kind of training most suitable for a disabled worker.

Physical Qualifications Report—Fig. 3

UNDER this system there are two distinctly different ways in which the physical capacities of workers may be reported by physicians. The first is described here in connection with Fig. 3, and the second is explained in the description of Fig. 4. Depending on the needs of the plant, both ways have advantages.

The first method (Fig. 3) may be used in those situations where no great quantity of hiring is being done and where the worker is not being considered for more than three job openings. When, however, as is often true for the semi-skilled and unskilled occupations in large plants, the worker is being considered for any of perhaps 15 job openings, then the second method should be used (Fig. 4). The second method, however, may also be used in small plants.

For Fig. 3, the first method, the placement officer first determines the worker's skills for the jobs open, refers to the Master Chart to obtain the job numbers of the jobs for which the worker is being considered, and enters these job numbers and worker's name on the Physical Qualifications Report (Fig. 3). The worker is then sent with this Card to the physician.

The physician examines the worker and records his findings on the regular medical department forms. The physician then refers to the Master Chart to view the physical demands of the jobs for which the worker is being considered (as indicated by the job numbers on the Physical Qualifications Report prepared by the placement officer). In the light of his medical findings on the one hand and the physical demands information on the other, the physician can usually determine easily whether or not the worker is physically qualified for a specific job. He then completes the Physical Qualifications Report simply by checking *Yes* or *No* after the job numbers, signs his name and returns the worker with the Card to the placement officer.

This method, in addition to taking less than a minute of the physician's time, has the advantage of greatly simplifying the physician's task of evaluating the worker's physical capacities. After examining the worker and the physical demands of his job, it is far easier for the physician to say, for example, that the worker *could* or *could not* lift 50 pounds for an hour a day than it would be for the physician to determine how much the worker *should* lift. Likewise, this method has the advantage of furnishing the placement officer with a direct answer as to the physical qualifications of the worker for a specific job.

Unfortunately, this simple and easy method has disadvantages. Since placement officers should not judge workers' physical capacities, the physician needs to complete a Physical Qualifications Report for *every* worker examined. (With the second method, the physician makes out Physical Capacities Reports on physically limited workers only.) The Physical Qualifications Report qualifies a worker physically for specific jobs only, and thus a question arises as to the worker's physical capacities in the event of job transfers or up-grading, often requiring additional physical examinations. (The second method eliminates this disadvantage.) Other than the knowledge that a worker is physically qualified for a specific job, the Physical Qualifications Report gives no information as to what the worker's physical capacities really are. (The second method also eliminates this disadvantage.)

Physical Capacities Report—Fig. 4

THE Form shown in Fig. 4 illustrates the second method for reporting the worker's physical capacities. The Form is designed and made up to register exactly with the Master Chart. By placing it in position on the Master Chart and sliding it up or down, the worker's capacities may be compared very easily with the job demands.

In the example, Arthur K. Styles, an automotive mechanic with heart disease and greatly reduced capacities, would probably have considerable difficulty in being placed in his line of work with ordinary placement methods. Under this system, however, where de-

tailed and specific comparisons may be made with ease, the capacities of Styles more than satisfy the demands of Job Number 30.

The Physical Capacities Report is completed by the physician after examining the worker and recording his findings on the regular forms of the medical department. This Report needs to be made out *only* for workers with limited capacities. This is so because fully able-bodied workers would have blank Reports and hence it can be assumed by placement officers that workers have full capacities when they come from the physician without a Report.

Using carbon paper, three copies of the Report should be prepared on each physically limited worker, one copy for the medical files and two copies for the placement officer. After selecting the worker's job, the placement officer sends one of the two copies on to the worker's supervisor and files the other in the worker's personnel folder. The diagnosis is stated on the physician's copy *only*. Each day the placement officer sends the physician a list of the job numbers of the jobs on which the physically limited workers were placed. For his records, the physician enters the job number in the appropriate box of the Physical Capacities Report.

This second method for reporting the physical capacities of workers, while appearing more difficult, actually has many advantages. It is positive in that it states the abilities of the limited worker and not his diagnosis and disabilities. It states the abilities of the individual in detailed and specific terms. Until the worker's capacities change, the Physical Capacities Report remains a permanent and complete record. It can be used in conjunction with the Master Chart by supervisors or personnel officers in transferring or up-grading the worker. Supervisors find it particularly helpful to have such a complete picture of their workers' capacities, not only for up-grading purposes but in making special assignments from time to time.

Strange as it may seem, this method takes far less of the physician's time than the simpler first method (Fig. 3). While the first method consumes less than one minute for each worker, it requires the physician to complete a Card on *all* workers examined. This second method takes from two to three minutes per case, but a Report is made out on physically limited workers *only*. (In several large studies, about 6% of the applicants were found to be physically limited.) The Physical Capacities Report, then, not only saves the physician's time in the long run but eliminates the disadvantages of the first method.

The chief difficulty with this second method is (to use a previous example) that it is harder for the physician to determine how much a worker *should* lift (second method) than it is to say that a worker *could* or *could not* lift 50 pounds for an hour a day (first method). This difficulty exists since no reliable standards have been developed for measuring the physical capacities of workers. How much can an individual lift, stand, walk, carry, climb, stoop or reach? At the present time, answers to such questions are matters of physicians' judgment. No one, however, is better qualified than the physician to make such judgments. In the placement process, too often are unqualified personnel shouldered with the task of attempting to translate diagnostic data into working capacities. Even though the physician's opinion may not be perfectly accurate, his opinion is still the best available judgment. It is the physician's responsibility to convert his negative findings into positive terms, his task to determine the physical capacities of workers to the best of his ability.

It might be suggested that the first method (Fig. 3) also could be used for physically limited workers only and thus save still more time in addition to simplifying the physician's task of evaluating workers' capacities. This could be done by the placement officer sending all applicants to the physician with the Card (Physical Qualifications Report) listing the job numbers of the jobs for which the worker was being considered. After giving the physical examination, should the worker be found to be fully able-bodied, the physician could ignore the Card and return the worker to the placement officer who would then assume that the worker was physically suited for any job since no Physical Qualifications Report was made out for the worker by the physician. Only in those cases where the physical examination revealed physical limitations would the physician review the demands of the jobs for which the worker was being considered, check the job numbers *Yes* or *No* on the Card and return the worker with the Card to the placement officer who would then know that the worker was physically limited and either was or was not physically qualified for the specific jobs under consideration.

Since both the first and second method have advantages, the specific industrial situation determines the choice of the methods to be used by the physician, the first method possibly being better for small plants, the second for large plants.

In connection with other practiced methods for placing physically handicapped workers,[1,3,4,5,6] both the first and second method of this system may be compared. With the first method (Fig. 3), the physician examines the worker in the light of the physical demands shown on the Master Chart, and then reports *Yes* or *No* that the worker either can or cannot fulfill the demands of the jobs under consideration. Of all plans, this first method is probably the easiest and most accurate for the physician. With the second method (Fig. 4), where the physician reports the capacities of workers for work in general (rather than for specific jobs as under the first method), the physician is afforded greater flexibility of opinion than with other methods and at the same time it is possible for him to state his more flexible opinions in specific terms.

In using the Physical Capacities Report, if the physicians believes that worker has the capacity to perform an activity for only ½ the work day, then he marks that activity 4 hours; ¼ the time, 2 hours; ¾ the time, 6 hours. As his judgment dictates, the physician is free to say that a worker may perform an activity up to 0, 1, 2, 3, 4, 5, 6, 7 or 8 hours, or even for fractions of an hour. He no longer has to deal in subjective terms such as "light" and "moderate." He can give meaning to these terms by stating specifically in hours what he considers "light" or "moderate" for an activity as it concerns the specific individual.

Nor need the physician's judgment any longer be restricted and forced into the categories of a discrete scale, such as "none, little, moderate and great," "0, 1/3, 2/3 and 3/3," or "A, B, C and D Work." This second method affords complete flexibility of opinion and, fortunately, at the same time, yields specific data. Thus, used in conjunction with a Master Chart, the Physical Capacities Report facilitates the more accurate matching of a worker's physical capacities with the physical demands of any job in the plant.

Trial of Plan

IN DEVELOPING this plan, the writer had the opportunity to test its reliability and validity in two plants, one small, the other large. Fortunately, both

methods for reporting the physical capacities of workers were tried, the first method (Fig. 3) in the first study (small plant) and the second method (Fig. 4) in the second study (large plant).

STUDY No. 1.[1,7,8,9] During the last quarter of 1944, five days were spent in training two job analysts in physical demands analysis work. The two analysts, in the next five days, analyzed 25 jobs in a plant of 2,500 workers concerned with used military clothing—unpacking, sorting, cleaning, repairing, pressing, packing and shipping. The 25 jobs analyzed accounted for 85% of the 2,500 workers, the administrative and clerical jobs not being analyzed. The two analysts worked independently and each one analyzed all of the 25 jobs. The results of their independent work were compared and correlated, yielding a reliability coefficient of 0.90. Upon discussing their few differences, full agreement was reached. Their work was verified with the plant supervisors and foremen. During the next two days, all the data obtained by the analysts were studied and arranged on a one-page Master Chart, photostatic copies being made. Thus the plan was ready to put in operation after spending a total of 12 days in training the analysts and in obtaining and processing the physical demands data.

The next step was to instruct both the placement officers and plant physicians in the use of the data. This was simple and took one day. Placement officers were given a photostatic copy of the Master Chart and shown that the jobs were arranged alphabetically and numbered from 1 to 25. They were also given a supply of the 3 in. x 5 in. Card, Physical Qualifications Report (Fig. 3), and instructed to enter the applicant's name and the job number of each job for which there was an opening and for which the applicant possessed the skills. They were then to send the applicant with the Card to the plant physician.

The two plant physicians also were given copies of the Master Chart and shown the Card (Physical Qualifications Report) and how the placement officer would list the job numbers on the Card. After examining the applicant, the physician was to refer to the physical demands data on the Master Chart and decide whether or not the applicant had the capacities to meet the demands of the jobs under consideration. The physician was to check the *Yes* or *No* column after the job numbers and return the applicant with the Card to the placement officer who would then know how to assign the worker.

It also was pointed out that when a worker was (or was not) physically qualified for a particular job, he then at least did (or did not) possess the physical capacities to meet the demands for the job as shown on the Master Chart and that, if the need arose, this knowledge could be used in the future to transfer the worker to other jobs within the range of his capacities thus indicated. Also, in the event that the worker needed a job transfer as a result of illness or injury, the placement officer could interview the worker to determine if he possessed the skills for jobs with lesser demands than his present job, and, if he did, the worker could be sent to the physician with a Card to find out which of the easier jobs were suited to the worker's reduced capacities. Should the worker contact the physician first, then this information might be originated by the physician.

The effectiveness of this plan was studied during the first six weeks of its operation. The two plant physicians both examined the first 100 applicants independently. The results of their independent judgments were compared and found to conform in all but two cases which were resolved upon discussion. These physicians pointed out that this uniformity of judgment could be attributed largely to the fact that after examining the applicant it was relatively easy to decide whether or not the applicant could meet the demands of a job by referring to the specific requirements of that job on the Master Chart. These two physicians particularly admired the simplicity of the system and the almost effortless ease with which the form could be completed.

During the six-week period in which this plan was studied, 110 applicants were hired and placed on jobs in accordance with the plan. Of the 110 workers placed, not one worker left for physical reasons. During the immediate six-weeks period prior to this study, 10% of the workers leaving gave physical reasons. Six months prior to this study, 17% of the workers leaving in a six weeks period gave physical reasons.

Owing to wage differentials, it is to be pointed out that this plant did not attract the average worker of the locality and had to rely on marginal workers. Many of the 110 workers placed, therefore, were true problems for selective placement because of age, sex and physical handicaps.

STUDY No. 2. On May 1, 1945, the second study was undertaken at the largest supply depot in the world, a permanent establishment covering over 500 acres with large one- to six-story buildings and employing about 10,000 civilians and several thousand servicemen. The Depot, while under one command, is composed of eight Branches, each comparable to an independent company or plant.

The first two weeks of May were spent in presenting the project to the officials of the eight Branches separarately, in selecting a staff of four job analysts, and in equipping an office and arranging for vehicles in order to cover the large plant.

During the last two weeks of May, the four job analysts were trained in physical demands analysis work; its development and practice in industry and government in the United States were outlined and guest speakers were introduced from time to time—physicians, personnel men, experienced job analysts, safety men, rehabilitation officers and educators.

The organizational structure of this large Depot was studied in detail during the first week of June and the number and location of the jobs were calculated. This was not a simple task. It was decided to analyze the per diem jobs only—the trades, which accounted for about 60% of the 10,000 civilian workers —and to exclude the per annum jobs—the administrative and clerical occupations, which accounted for about 40% of the workers. It was decided also to analyze only the per diem jobs in the four main Branches which employed 94% of all the per diem workers in the Depot.

In one month's time, June 6 to July 5, 1945, the four job analysts analyzed all the per diem jobs in the four main Branches of the Depot. In all, 636 job studies were made, netting 317 physical demands analysis schedules (Fig. 1). To make this clear, one job may appear in more than one location or department in a plant. The job must be analyzed as it appears in each location. Often, however, the demands of the job are the same in the different locations and one schedule suffices, the different locations being indicated on the one schedule. Hence, in this study, the 636 jobs studied netted 317 schedules.

Next, through concern with accuracy, it was decided to have each analyst analyze each of the other analyst's work, in short, to have four judgments on

the demands of each of the 636 job studies. This task was accomplished from July 6 to August 11, 1945. In addition, each of the 636 job studies was verified with the respective supervisors and foremen of the jobs. Reliability measurements of the analysts' work were made and it was found that they were making an error of 3.7% per analyst. Their errors clustered around the sensory factors of Depth Perception, Color Vision and Hearing. After extensive discussion and further clarification, the schedules were corrected for error.

Then came the make-up and first drafting of the Master Chart, August 12-28, 1945. While the analysts considered 82 physical and environmental factors in analyzing each job, nine factors were not required by any of the 636 jobs studied. Hence, these nine factors were deleted and the Master Chart was made up of the 73 required factors. (The illustration, Fig. 2, is the first page of the final 10-page Master Chart.) The Master Chart was checked 10 times for accuracy. After the Master Chart was drafted, the physician's form (Fig. 4) was made up to register exactly with the Master Chart.

At this point, (when all concerned felt pleased with the results and appearance of an accurate study), the "real problem" remained to be faced: reproduction—expert final drafting, photographic plates, printing, collating and binding of the Master Chart. This process took four months and delayed the start of the program until the beginning of 1946.

With proper instructions to physicians, placement officers, safety men, supervisors and foremen, the Master Chart was released during the first two weeks of January, 1946. (Their use of this material has been described earlier in this article.) Master Charts and related forms were released also to rehabilitation centers and to the U. S. Employment Service.

On January 15, 1946, the program officially started at the Depot. It was decided to study its effectiveness for a three-month experimental period, January 15 to April 15, 1946. Did this technique help to place the handicapped, and what effect did it have on turnover, absenteeism, accidents, production and morale? With this question as a base various studies were made to measure the validity of the technique. Comparisons were made for the per diem workers placed during this experimental quarter with the per diem workers in the four Branches during the four quarters of 1945 and the first quarter of 1946.

During the experimental quarter, 872 per diem workers were placed in the four Branches studied. (In 1945, about 1000 workers were hired each quarter.) Of the 872 workers placed, the physician found 822 to be able-bodied (possessing full physical and environmental capacities for work) and 50 workers (5.7%) to be physically limited (not possessing full physical and environmental capacities for work). The physician made out Physical Capacities Reports (Fig. 4) on the 50 physically limited workers only (since the able-bodied workers would have had blank Reports). The physician spent between two and three minutes making out each of the 50 Reports.

The remarkable fact of this experiment was that all 50 of the physically handicapped workers, placed on jobs under this system, would have been rejected for physical reasons under previously used placement procedures.

The 50 handicapped workers had the following disabilities: 24 orthopedic, nine hernia, five cardiovascular, one gastro-intestinal, three vision, one hearing, two neuro-psychiatric and five miscellaneous.

In addition to the 872 workers placed during this experimental quarter, 88 workers were given physical examinations but were not placed. Out of the 88 workers not placed, 72 were able-bodied, who declined to accept the jobs offered them, and 16 were physically handicapped. Eight of the 16 handicapped workers declined the jobs offered and eight could not be placed (six orthopedic, two miscellaneous) since they did not possess the physical capacities for the jobs for which they were otherwise qualified. It is significant, however, that the eight physically handicapped workers, who could not be placed for physical reasons, could have been placed under this system on any of several jobs in the four Branches had they possessed the skills for these jobs. With this knowledge, it is evident that this system also may be used to assist rehabilitation officers in helping handicapped workers to acquire the skills for the jobs for which they possess the physical capacities.

Additional placement data on the 872 per diem workers placed during the experimental quarter is shown in Table 1.

TABLE 1.
PLACEMENT OF PER DIEM WORKERS IN THE FOUR BRANCHES OF THE DEPOT
SEX, AGE, RACE, VETERAN STATUS AND SKILL LEVEL
ABLE BODIED AND PHYSICALLY HANDICAPPED
JANUARY 15 TO APRIL 15, 1946

	Able-Bodied	*Physically Handicapped*	*Total*
Sex			
Male	822	50	872
Female	0	0	0
Age			
Under 30 yrs.	536	35	571
31-40 yrs.	228	10	238
41-50 yrs.	42	2	44
51-60 yrs.	13	3	16
Over 60 yrs.	3	0	3
Race			
White	228	25	253
Negro	570	23	593
Other	24	2	26
Veteran Status			
Veteran	751	46	797
Non Veteran	71	4	75
Skill Level			
Skilled	165	3	168
Semi-Skilled	143	22	165
Unskilled	514	25	539
Total	822	50	872

For the experimental quarter, the resignation and discharge rates (turnover) for the 872 per diem workers placed were found to be comparable with the resignation and discharge rates for the per diem workers in the four Branches as a whole. The only remarkable variation was that none of the 50 physically handicapped workers left for physical reasons (ill health, or physically unable to perform duties). During the four quarters of 1945, physical reasons were given by 24%, 18%, 9% and 9% of the per diem workers resigning.

Also worthy of comment in connection with resignations for physical reasons is the fact that with such a tool as this technique affords the physician the chances for error in his judgment are likely reduced. Out of the 872 workers placed, seven of the able-bodied workers gave physical reasons as the basis for their resignations. Only one of these seven resignations was due to possible error on the part of the physician, or one possible error out of 872 judgments, the remaining six resignations being for the purpose of operations for non-industrial ailments.

In connection with the rates for sick leave, accidents, production and morale, no significant variations were found when comparing the 822 able-bodied workers placed during the experimental quarter with the averages for the per diem workers in the four

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Volume 15 OCTOBER, 1946 Number 10

Physician to the President

AN EFFECTIVE editorial on certain important phases of the industrial physician's responsibilities is embodied in current expressions on medicine and its relation to industry. Thus, from DR. SAMUELSON'S article (page 566): "As one goes up the level of responsibility and reaches the management group who carry a heavy administrative load, one must pay particular attention to their well-being. This is necessary for three reasons: the first is because of the importance of the positions they hold; the second is that their work load may be a predisposing factor to a general physical breakdown; and third, that people in this level have a sense of responsibility to the organization which causes them to continue working when physically they should not. By continuing work they further endanger themselves. It would be better for them to take time off early when indicated. In many instances this might prevent more serious illnesses and greater loss of time, which is subsequently apt to occur." This is enlarged upon and emphasized in an excellent and timely article by DR. ROBERT COLLIER PAGE, General Medical Director, Standard Oil (New Jersey)*: "In industry the physician's position on the organization chart is important. In any terms he must have a staff position, which affords him ready access to top management on each needful provocation. *His salary must be commensurate with the duties that he is expected to perform. Furthermore, to be truly effective the president of an organization must consider the staff physician as his doctor; he must be personally guided by his advice.* If this is common knowledge throughout the organization, the rank and file will immediately fall in line with most gratifying results. . . . It is inevitable that a high standard of a constructive medical program. . . . will be expensive. It involves considerable time, equipment and an unusually high level of diagnostic acumen on the part of

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Branches as a whole. However, once again, contrast was shown when these rates for the 50 physically handicapped workers were compared. For instance, the handicapped workers took sick leave for 1% of their work hours as compared with 3% for the others. The handicapped workers had no lost time accidents while the other per diem workers had 24 lost time accidents. In connection with production records, 14 of the 50 handicapped workers were judged by their supervisors as being superior workers (one as being the best worker in a department of nearly 1,000 workers), 29 were judged as being average workers, and seven as being fair workers. In interviewing the supervisors, in no instance was lowered morale reported as a result of employing the physically handicapped workers, but, on the contrary, the general belief was that morale was increased and several specific examples were given where it was believed the morale of the group as a whole had been raised.

IN ORDER to keep the program current, the physical demands analyses must be kept up-to-date. This task, however, is not great. Even with the plant changes caused by the ending of the war, since the original analysis of the 636 jobs was completed in July, 1945, only 30 jobs have been deleted, 27 new jobs have been created and analyzed (and the data entered in the appropriate blank spaces on the Master Chart), four jobs have had major revisions made in their physical demands, 24 jobs have had minor revisions made in their physical demands, and the analyses of all the per diem jobs in the four Branches were thus current as of April 15, 1946.

Once the physical and environmental demands of the jobs have been analyzed and the Master Chart prepared, this comprehensive plan, based on a positive, individual and specific approach, requires a minimum of time, effort and expense to maintain its operation.

Summary

A TECHNIQUE for placing physically handicapped workers has been described and discussed. The results of trial in both a small and a large plant suggest that this technique may be pointing toward the solution of the problem of placing the handicapped.

[For their sympathetic criticism of this article, the writer is indebted to EDWIN E. GHISELLI, PH.D., Professor of Industrial Psychology, and ROBERT T. LEGGE, M.D., Professor Emeritus of Hygiene, of the University of California, and to WILLIAM F. DURAND, D. ENG., Professor Emeritus of Mechanical Engineering, and CHARLES K. FIELD, Writer, of Stanford University.]

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the physician to be effective. But its cost can be readily justified on economic grounds. For example, the value of service that can be rendered to key personnel alone is difficult to calculate, but management well knows that 'wisdom and judgment are conditioned by experience, and experience depends upon time for its acquisition. The greater the specialization, the greater the difficulty in finding replacements. The greater the responsibility, the heavier the wear and tear.' It follows that the best medical supervision and advice should be available at all times." (Italics ours.)

*"Constructive Medicine and Industry," by ROBERT COLLIER PAGE, M.D., in *Journal of the American Medical Association*, 132:2, 56-58, September 14, 1946.

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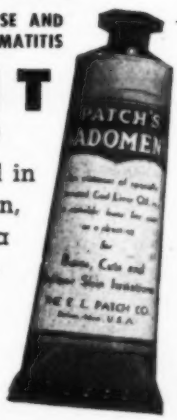

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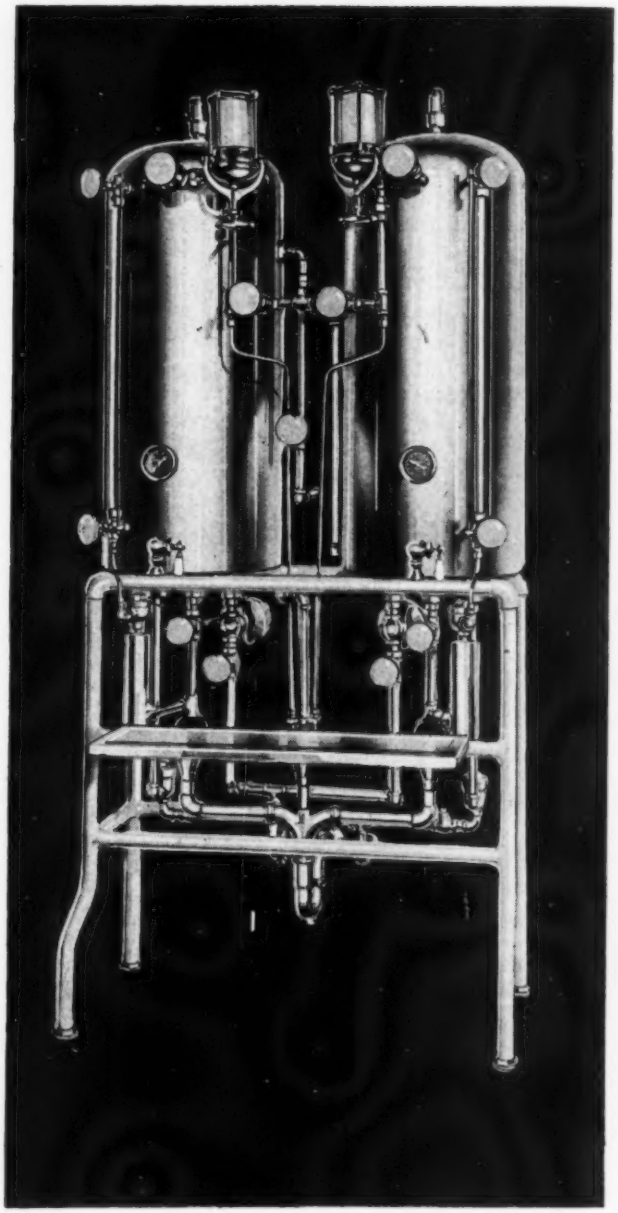

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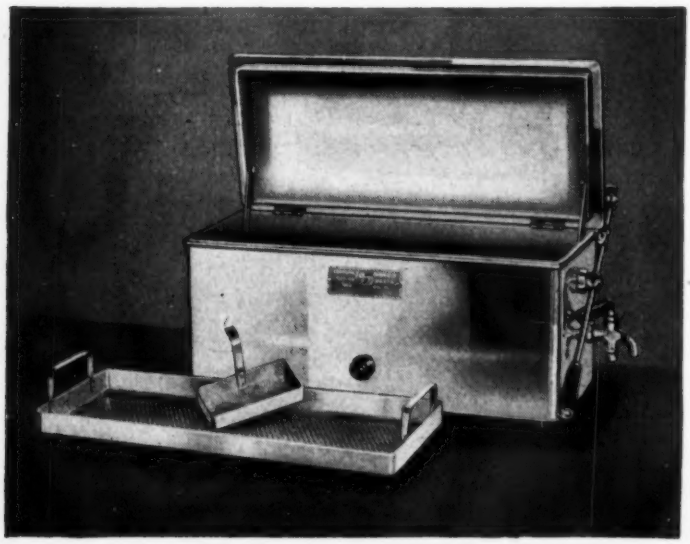

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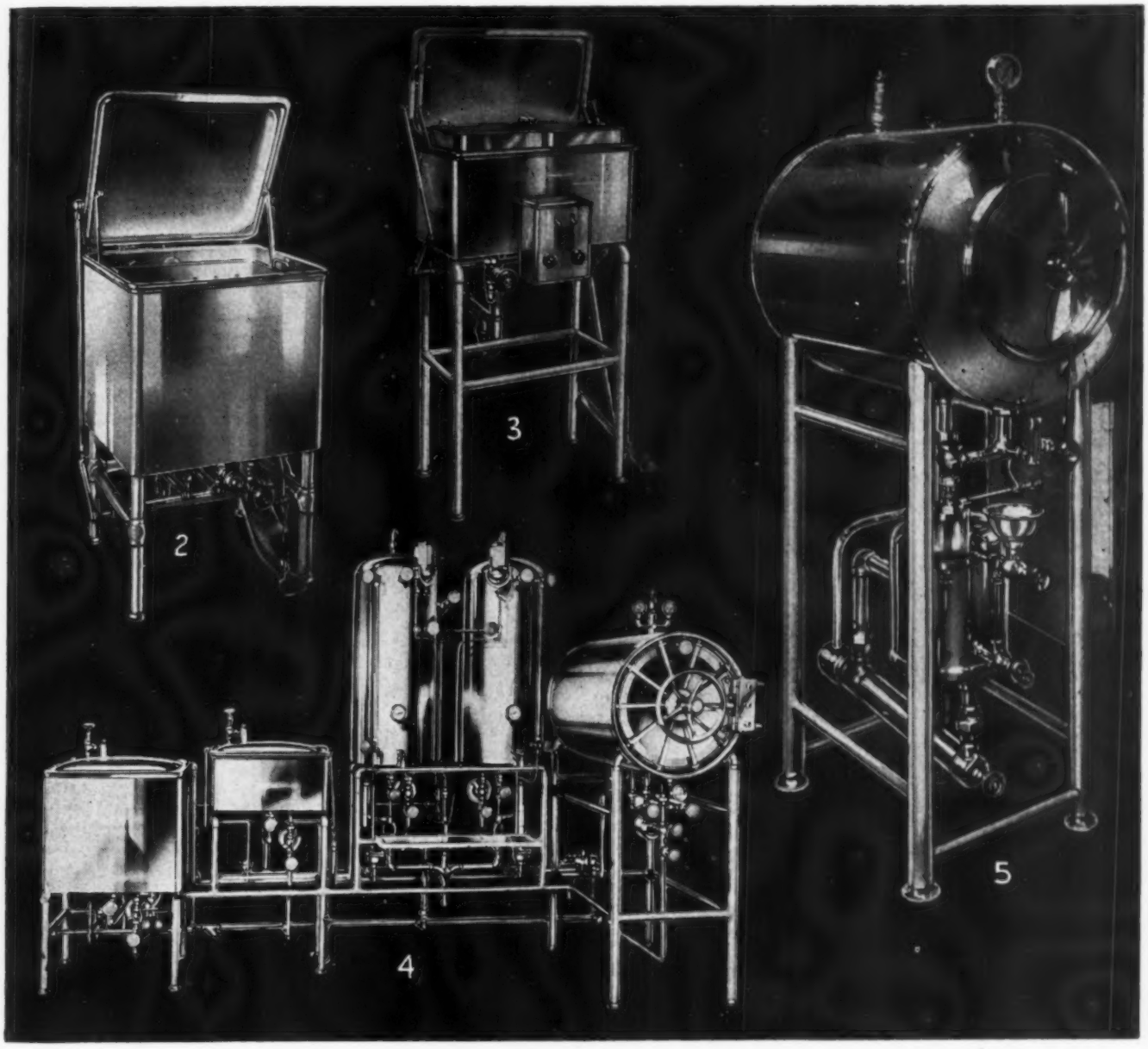

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Establishing a Modern Plant Medical Program

By ROBERT B. O'CONNOR, M.D.,
Newark, N. J.

NOT ONLY is an adequate plant medical program a potent means of improving employee health and morale; it is also a paying proposition, which more than returns its cost in reduced compensation expenses, decreased absenteeism, lower turnover, etc. (One survey found that, on the average, a health program saves a 500-employee plant more than $5,000 annually.) The author of this article, who is chief physician of a large manufacturing firm, discusses the basic elements of a modern medical program and shows how its effectiveness can be measured. Particular attention is directed to the industrial relations aspects of the medical program and to problems of medical ethics.

Reprinted from *Personnel*, July, 1946.

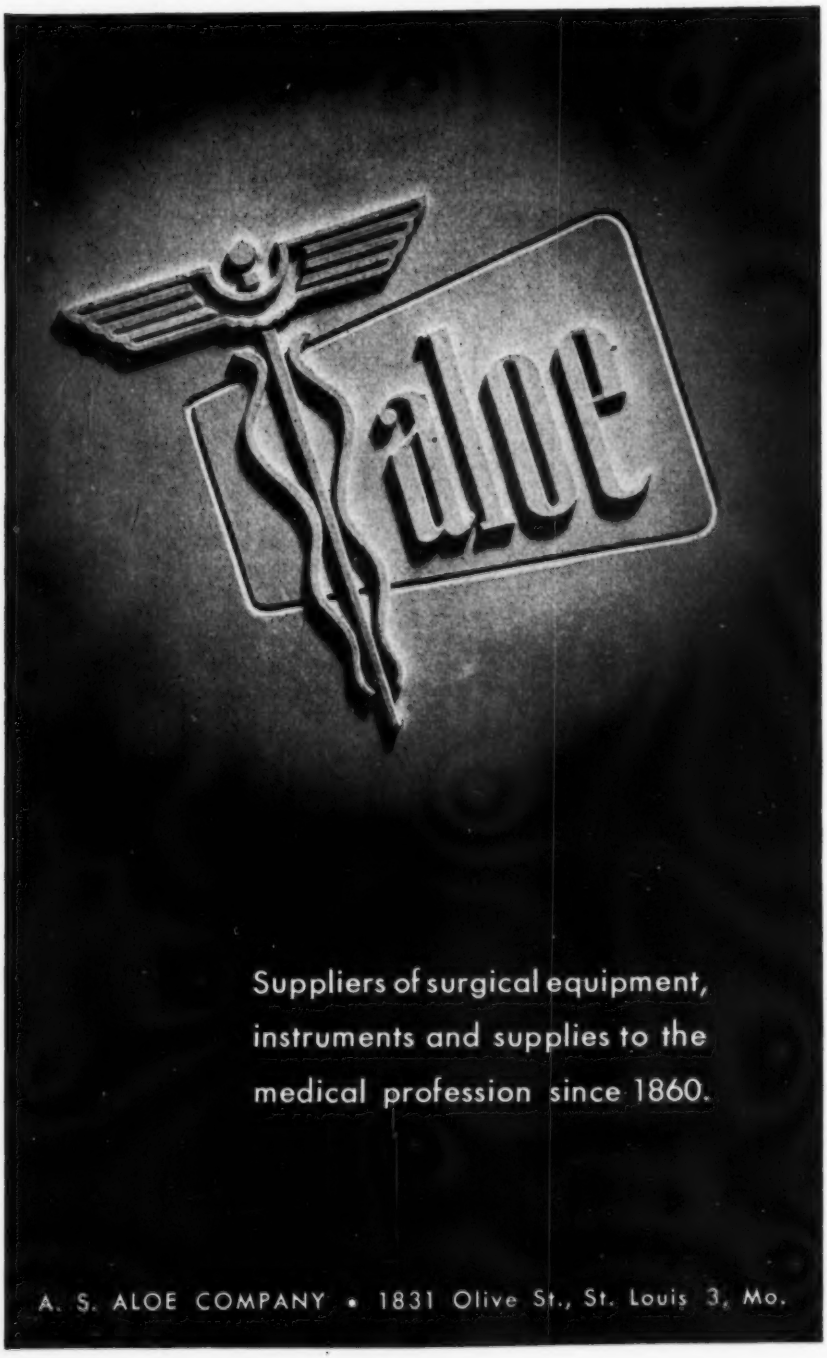
HOW often does management insure its workmen's compensation liability with a carrier, pay its premiums, and accept the cost entailed as inevitable? The premium payments are based on the hazards each particular industry presents and on past compensation cost experience. If these monies were handled by one of the departments in the plant, management would continually seek ways of reducing such expenditures—yet at least 80% of present-day companies seem completely resigned to the truly "pathetic waste of money" paid out by them in compensation. Workmen's compensation laws logically suggest a medical program in every industry, and if there is no medical program, or an inefficient one, then "pathetic waste" will inevitably follow.

Management's responsibility to its employees changed drastically when the states set up workmen's compensation laws. Prior to that time a company was not responsible for an injury sustained by an employee at work, unless he could prove in a court of law that management's negligence was a contributing factor in his injury. Now, under the workmen's compensation law, whether management's negligence contributed to his injury or not, it must furnish him with adequate medical treatment, even hospitalization and surgery if necessary; it must pay a stipulated portion of his wages weekly if he loses time, and it must pay a scheduled sum if he sustains permanent disability from his injury. In fact, the results of any accident "arising out of and in the course of his work" are the employer's direct legal responsibility. Many of the states include certain occupational diseases arising out of the work; a few states include "any and all occupational diseases." All these developments have taken place since 1910. The enactment of workmen's compensation laws and their administration are state functions, hence the several states have varied degrees of coverage. Compensation laws were originally enacted for the benefit of both the employer and the employee—*i.e.*, to protect the employer from ruinous law suits and the employee from the financial loss arising out of an injury at work. Subsequent broadening coverage and more liberal interpretation of the laws have increased the employees' protection and have thus increased the cost to the employer.

The wish to reduce compensation expenditures does not in any way stem from a desire to deprive an injured employee of his just deserts. The wasteful costs are the result of infections and other complications, of excessive loss of time because of the absence of a rehabilitation program, of payments of spurious claims, and many other causes.

When an employee appears at a compensation hearing and swears that his condition was non-existent before he was hired, the Compensation Commission will accept his word unless it can be proved false. How can the employer hope to refute fraudulent claims unless he has his employees examined before hire? The saving in proving one pre-existing hernia case, for instance, will probably pay for over one hundred pre-employment examinations.

When an employee is injured and management simply tells him to "go see his family doctor" he may neglect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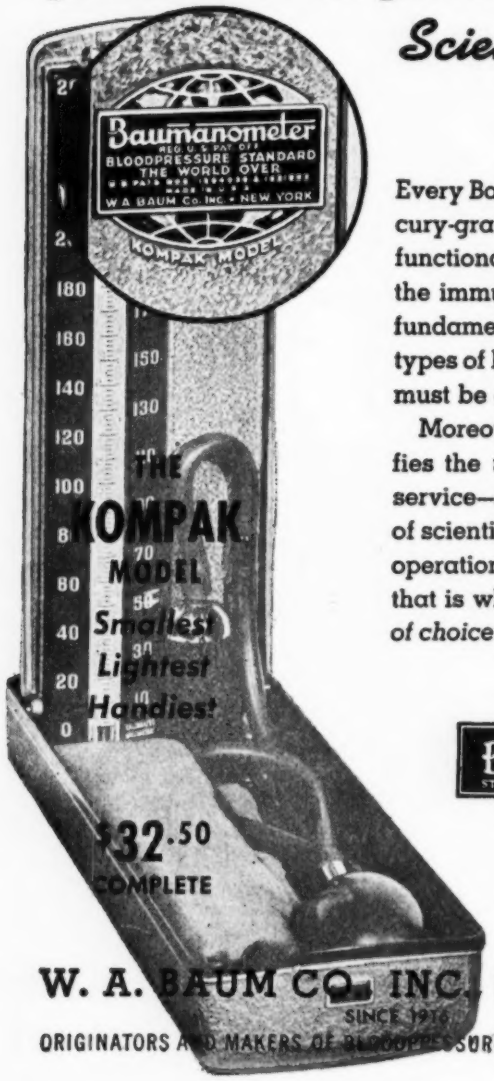

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to do so, thus inviting infection or other complication. He may go to a general practitioner whose experience in industrial medicine and traumatic surgery is decidedly limited. Since the employer must pay for the prolonged convalescence and the poor end-result, is it not more logical to provide immediate and adequate medical care?

When the compensation laws make the employer liable for an occupational disease contracted from an exposure in the plant, management is inviting further waste of money when it permits such toxic exposures to continue. Is it not more intelligent to set up a simple industrial hygiene program to minimize illness and injury arising from work?

The present broadening coverage of compensation laws and their increasingly liberal interpretation makes the need for a medical program now even more urgent. Will management continue to accept as inevitable the wasteful expenditures in compensation costs that a medical program can reduce?

Scope of the Modern Medical Program

THE BASIC elements of a modern medical program are pre-employment examinations, facilities for the care of the injured employee, periodic examinations and an industrial hygiene program.

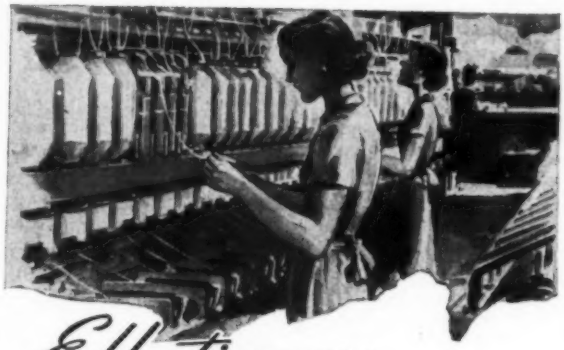
The pre-employment examination lays the groundwork for an industrial medical program. It initiates the employee's plant medical record; it rules out those with contagious disease or with certain specific conditions that will render them unfit for factory work. It permits accurate placement on a job commensurate with the applicant's physical abilities. It lists pre-existing conditions to refute subsequent fraudulent claims, and it discloses remedial defects, treatment of which will improve the health of the worker.

In a small industry placement must be accomplished by one who knows the physical demands of each job. In a large industry this can only be accomplished by an analysis of each job to include its physical demands and working environment. The United States Employment Service has drawn up very satisfactory forms to facilitate such job analysis, and their fundamentals have been widely used in industry during the war. With such a job analysis and a parallel physical capacities appraisal by the examining physician, an employment interviewer can place with considerable accuracy the new employee in a job that fits his limitations.

When such a pre-employment examination is undertaken it must be thorough for obvious reasons. A recording in some detail of existing disabilities is absolutely necessary in compensation liability since systems or parts not examined are considered negative and hence free of pre-existing conditions by the compensation court. Moreover, the employer cannot assure safe employment of the applicant unless *all* of his defects are known. A routine urinalysis and blood Wassermann test should be part of the examination. A chest x-ray should be included if facilities permit or if the industry entails specific dust hazards. Even listing of ranges of motion in previously injured fingers or other joints is of value in apportioning disability if the applicant sustains further injury in the course of his employment.

Staffing and Equipping the Medical Department

THE SECOND basic element of a medical program is the care of the injured employee. Ideally, all necessary facilities should be included in the medical unit. However, this must necessarily vary according to the size of the plant. A plant of 250 employees must limit its equipment to the simple essentials, whereas a plant of 3,000 or over can benefit by the purchase of several physiotherapy modalities, an x-ray unit, and other types of equipment. It is simple mathematics to prove that a sizable plant will save money by the purchase of an x-ray unit since the cost of x-ray of from $5 to $15 per case can thus be reduced to $1.50 to $2. The number of patients x-rayed will, of course, determine the saving involved. When an x-ray unit is on hand, more cases are x-rayed because the equipment is readily available. Thus fewer fractures are overlooked and improperly treated, and further saving through better medical care is a direct result. Similarly, the purchase of an inexpensive infra-red lamp will save manpower hours and medical expense, even though the



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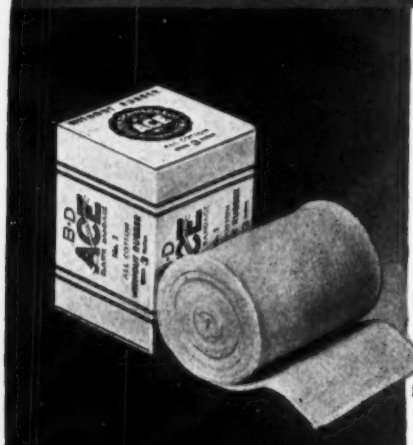

• Because it's the original Ace Elastic Bandage that they have prescribed successfully for many years for the treatment of varicose veins and ulcers, strains, sprains, and injuries.

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volume of cases requiring it may be relatively small. The size and extent of the medical department is dependent upon the plant population and the type of industry. It has usually been found that the basic foundamentals of a medical unit will require expansion within a year after the program is begun, as employees come to recognize its availability and its value to them.

In general, one can estimate that 500 employees will keep one nurse busy full-time and 2,000 to 3,000 employees will keep one doctor busy full-time. Individual requirements can, of course, be scaled up or down from this base.

For the smaller plants a working rule of thumb is as follows: A doctor will be kept busy three hours per week per hundred employees and a nurse nine hours per week per hundred employees. Over-all costs have been estimated at $13 to $17 per employee per year for a medical program. Where size requires three nurses or a multiple of this, two nurses and a clerk will generally function equally well with less salary expenditure, since an industrial nurse spends over one-third of her time in record-keeping.

It is of utmost importance in plants of smaller size to make certain that the nurse is acting under the direct supervision of a licensed physician. An industrial nurse has no license to practice medicine; however, she can minister to the employees according to the signed "standing orders" of the physician to whom she reports.

It should not be necessary to point out that, however extensive and well-equipped the medical unit is, occasionally it will be necessary to engage the services of medical specialists for consultation on individual cases. These should be used without stint where necessary to assure speediest possible recovery and to prevent the occurrence of complications arising from a plant injury. Referrals to specialists depend entirely upon the breadth of training and experience of the industrial physician.

Importance of Periodic Check-up

ALTHOUGH the pre-employment examination furnishes basic medical knowledge about an employee, there is no assurance of its continued accuracy unless it is followed up with periodic examinations. Such periodic examinations are indicated especially for those employees who are subjected to toxic hazards on their jobs so that it will be possible to detect the earliest indication of toxic effects and remove the man from such exposure. Periodic examinations of the executive force and key personnel are also of particular value. Life insurance statistics have shown that periodic medical examinations actually can prolong the useful life of an employee by 25%. If he is a key person in the organization, the value of repeated health checkups is obvious. Such examinations should be followed by recommendations for correction of remedial defects.

It has been customary in many industries to conduct a yearly physical examination of key employees, an examination of the general plant population once every one or two years, and an examination of those exposed to toxic hazards every three to six months. Where the toxic exposure is particularly great, it may be necessary to conduct examinations at more frequent intervals. A concrete reason for such periodic checkups is evidenced in the following: A large corporation was not convinced that periodic physical examinations would pay for themselves until a robust guard whose blood pressure was normal at the time of hire suddenly had a stroke, due to marked high blood pressure, when he was driving an employee home in the company ambulance. He and the attendant were killed and the patient was badly injured. The total cost of that one accident would pay for several thousand examinations.

The Industrial Hygiene Program

AN INDUSTRIAL hygiene program is one of the basic elements of an industrial medical program that is often overlooked. The foundation for industrial hygiene begins in a plant survey to determine toxic exposures, concentration of fumes and dust hazards, the adequacy of plant sanitation, and other industrial medical liabilities. This survey can be undertaken by the plant medical department if it is sufficiently large and adequately staffed. Many compensation insurance carriers are able to undertake such hygiene surveys; the Mellon Institute will conduct such a survey for member companies; and, of course, such services may be per-

Schematic section of villi showing fluid exchange system through blood vessels whereby water is drawn into the bowel to help form "liquid bulk."

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formed by consultants in the field of industrial hygiene.

An industrial hygiene survey brings to light danger points in the plant which may lead to illness or injury, and is aimed at furnishing a basis for specific correction of hazards. Repeated surveys at six- to 12-month intervals are necessary as production methods change. Such a survey will result in greater cooperation between the medical and safety divisions. The need for this cooperation cannot be over-emphasized, for its absence in one division diminishes the effectiveness of the other.

Health education, an important part of industrial hygiene, is frequently carried on without being labeled as such. Every time an employee asks the industrial nurse or physician for advice on medical matters, health education is being given. The effectiveness of pamphlets and talks on health has been questioned by many, but these have been developed to a great degree by some companies. An article on current health problems by the company physician in the plant weekly or monthly paper is a good method of educating employees in health matters.

We have briefly discussed a few of the reasons why compensation laws logically suggest that management set up a medical program and have outlined some of its fundamentals. Now let us consider some of the industrial relations aspects of such a program.

Benefits

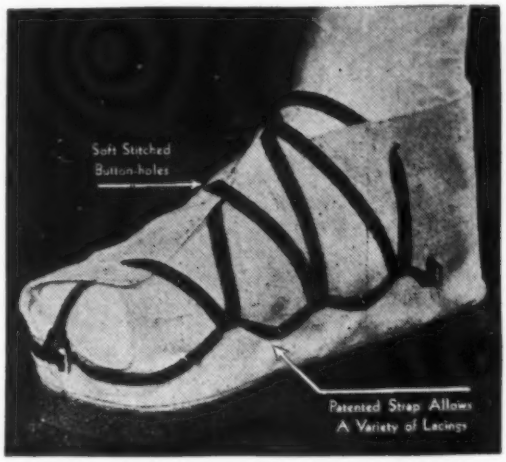
IT SHOULD be emphasized at the outset that a medical program is a very powerful factor in developing either good or bad industrial relations. At the outset, the program should be supported by publicity indicating that its purpose is the welfare of the employee and the improvement of employee health. This will indeed be its purpose, though it may have been originated through a desire to avoid wasteful expenditures under the articles of the workmen's compensation laws. The healthy employee is of much greater value to management than is the ailing worker and very little added effort beyond that which protects the employer's compensation interests is needed to improve workers' health. It is strongly to be urged that such publicity be utilized when the program is started because at that time, surprisingly enough, the employee often feels that the medical program is to be used against him, to deprive him of a job or of his just recompense under the law.

As the medical department develops, it will furnish a common meeting point between management, the employee, and the union. If the medical department is functioning well, the employee considers it entirely apart from management as such, and looks to its members as a group who have his interests at heart; the union will accept its recommendations and decisions as coming from an impartial group whose prime interest is the physical and mental welfare of the employee; and management will find in it an answer to many of its personnel problems.

The employee who is dissatisfied with his job, his supervisor, his shift, or his surroundings often reacts with physical distaste. He considers the job too strenuous or the hours wrong, or the surroundings too dusty, and he approaches the medical department with a request for work change on medical grounds. The industrial physician who is alert to such a reaction always inquires further into the man's mental responses to his job, his supervisor, etc. He can thus uncover situations affecting morale and production and incorporate into his approach the simple applied psychology of the personnel counselor; he can steer the employee to the counselor if the organization has one.

Union and Worker Support

AFTER A medical department is well established it should have gained the full support of the union. The union and the physician both have the same purpose in industry, viz., to work for the good of the employee. Thus the plant physician has a valuable approach to union demands that



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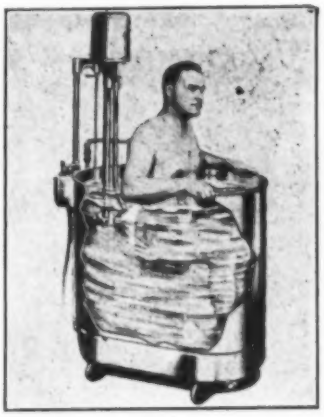

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*Pope, C. Physical Therapeutics 47:80, 1929.

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(1) Combes, F. C.: Indus. Med., July, 1944.
(2) Parkes, Morey: Indus. Med., January, 1944.

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is denied management. In the beginning it is common for the union to come to the medical department and demand justice for the employee. If the physician's decisions are fair and just, as they must be, he should welcome visits by union representatives to explain to them the reasons for his decisions. It has been found that this results in an understanding by the union representatives that only fair and honest decisions are made by the medical department and their questions will diminish; in fact, they will often defend the decisions of the medical department to the employee. On the other hand, the physician must never make an ill-considered decision and then reverse it under union pressure, for then the employee is led to believe that he will not be fairly treated unless he brings along the union steward for bargaining.

Management often finds personnel problems that have an unexpected medical facet. Consider the employee who had been a good worker, but whose work became so poor that his supervisor was about to discharge him for incompetence. The medical department found that he had a serious condition which adequate treatment by his family physician completely cured and restored him as a valued and useful employee.

Physicians associated with industry frequently tend to develop an attitude of tactless scorn and disbelief—the feeling that all complainants are "goldbrickers" and that it is not worth the effort to display interest in the employee and his progress. No single thing will more seriously affect the employee's opinion of the medical department. His reaction is, "They don't care what happens to me." Nothing will so negate the functions of the medical department, since industrial medicine's effectiveness decreases in proportion to the employee's lack of faith in its adequacy and honesty. The effect is as ruinous as it would be in private practice.

Scarcely any division in the organization can more adversely affect industrial relations than the medical department. The situation became so serious at one large plant that the union refused to sign a contract unless the incumbent medical director was discharged.

Strangely enough, the way he is treated in the medical department indicates to the employee what management thinks of him as as individual. If he is courteously and conscientiously treated, his reaction is, "Gee, management really does care what happens to me." If he is "kicked around" by a disinterested physician or nurse his attitude is, "They don't give a hoot about what happens to me." This reaction is universal and unavoidable in industry. A company that has a tactless, inefficient medical department will never attain ideal industrial relations.

Wasteful Expenditures

A MAJOR difficulty for the industrial physician arises from attempts to reduce compensation costs and still maintain good industrial relations. The only approach to this difficulty is to establish the major premise that the employee will be furnished everything he is reasonably entitled to and that only the pathetic waste of money that comes from poor control of cases and improper handling will be stopped. The employee and his supervisors may not have been adequately taught the need for immediate reporting and treating of all injuries, however trivial. Such neglect may permit infection to develop and can increase the number of permanent disabilities and the total time lost. Wasteful expenditure may be further increased if the industrial physician is inadequately schooled in the proper handling of industrial traumatic cases or is lax in the care of the cases, or not alert to the early recognition of complications.

One of the greatest causes of wasteful compensation expenditures lies in the philosophy that the employee cannot return to work until he is fully able to do his job. Statistics show that the injured worker under the care of a general practitioner is absent from three to five times longer than is the worker who is cared for by the industrial physician. A program for the early return to work of the injured employee will immediately decrease wasteful compensation expenditures as well as conserve valuable manpower. The average employee with simple back strain, for example, will lose two to six weeks work if he must wait until he is able to perform his full job. However, his knowledge and his limited physical ability can be used to good advantage if light work can be found for him during the convalescent period. Aside from stopping compensation payments for

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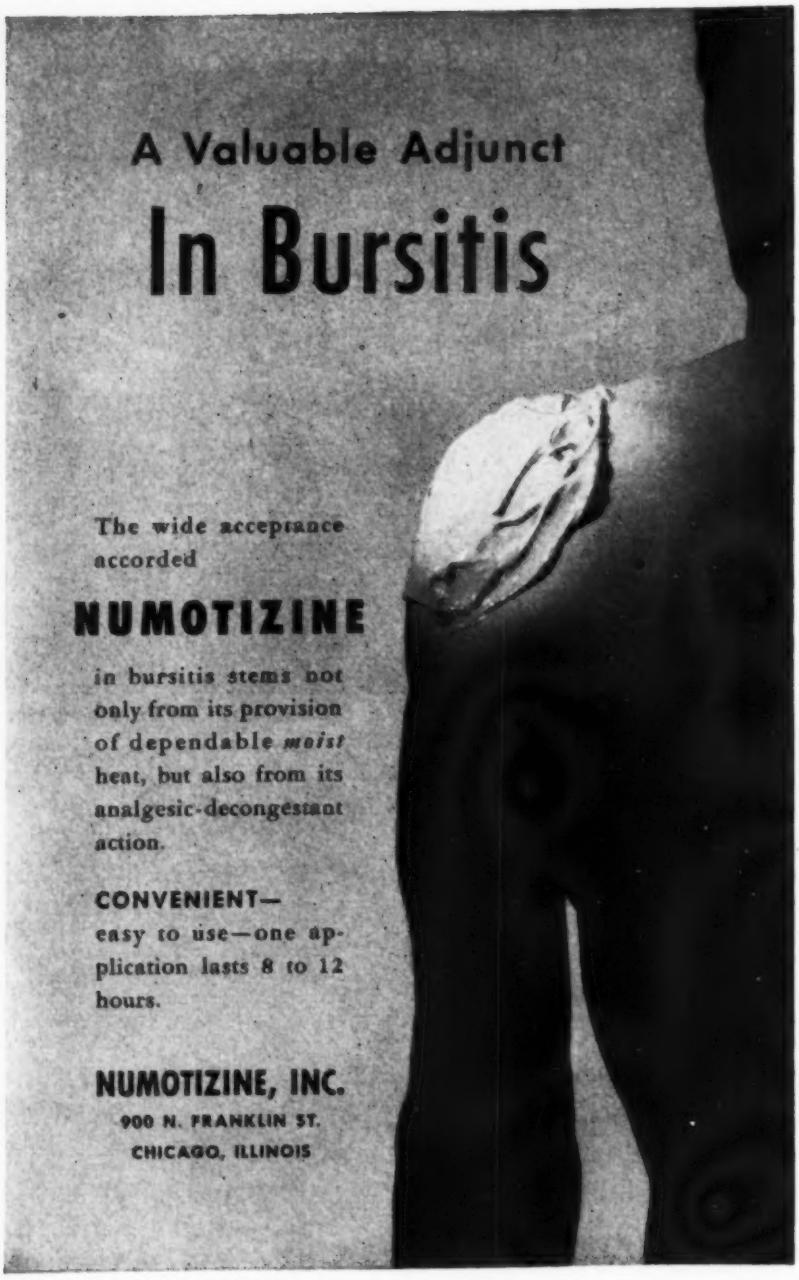
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lost time, and providing him with his salary instead, such placement prevents him from spending 24 hours a day, over a period of weeks, convincing himself that the company has ruined him for life, that he will never be the same, and that he certainly will never subject himself to such physical effort again. The employer may never get such a worker back on his old job after he has been given so much time for brooding. In fracture cases convalescence may be prolonged, and placement of the employee in limited work will provide occupational rehabilitation for earlier and more complete restoration of function, resulting in smaller permanent disability awards.

It has been argued that it is cheaper to pay an injured worker compensation than to allow him to return to limited work and pay his salary. This argument is fallacious because during the worker's absence, the company is deprived of all his production effort, though its cost continues. By paying him weekly compensation benefits during a prolonged convalescence, the employer is permitting costly traumatic neuroses to develop and is helping to create higher compensation awards for greater permanent disability. Aside from the loss of valuable production effort, the expenditure in compensation will be reflected in increased compensation premium over a considerable period of time. The establishment of a progrom which permits temporary light work assignment for injury cases will immediately and considerably affect the company's compensation expenditure.

The Program's Effectiveness

THE BEST way to determine the adequacy of medical department activities and control of cases is to make statistical analyses of cases and compensation cost trends. Regardless of the size of the medical department, a monthly review of case statistics and compensation expenditures is the only effective device for determining whether or not the department is performing its function. A high incidence of infection cases may disclose the need for earlier reporting of injuries and should stir the physician to concentrate on the medical problems connected with their control. The cost of eye cases may be found to be unduly high, indicating the need for a safety goggle program. A low rate of visits to the medical department may reflect employee's lack of faith in the medical department. Roughly one visit per month to the plant medical facility by each employee is to be expected. Analyses may show a high revisit rate, compared to the number of new injuries listed, pointing to over-treatment of cases or to abuse of medical privileges by employees who visit the medical department for a rest and smoke. Though individual case figures will vary, the average ratio of new injuries to revisits should range between 1 or 1.5 to 1.3. The allocation of a sizable part of the over-all compensation cost to one department or area will suggest the need of a serious study of this area with a view toward installing further safety precautions or providing further safety training for the supervisors and employees in this area. Rising compensation costs with a medical program in effect may suggest a serious revision of the department. Mounting costs arising from hernia cases will point out the need for more thorough preemployment and periodic examinations, and perhaps further installations of hoists on heavier jobs. These and a host of other worthwhile points will arise out of a careful monthly study of case statistics and compensation costs.

Cooperating with the Carrier

IN THIS statistical study the compensation insurance carrier can be of considerable help in pointing out those expenses which are inevitable and those which may be reduced, and in informing management of the ratio between the company's costs and the costs of other similar industries in the area. Close cooperation between the medical department and the compensation insurance carrier is necessary if the company is to provide efficient medical service. Prompt reporting of compensable cases to the carrier by the medical department permits early payment of lost-time benefits and prompt insurance investigation of questionable cases. Misunderstandings easily arise between the medical department and the carrier unless the two work closely. An overworked medical department may be late in reporting cases, suggesting to the carrier a lack of cooperation. On the other hand, the carrier's recommendation for improvement in the

medical activity may be interpreted as interference with industrial medical functions. The tactful suggestions which the carrier may offer for improvement in the medical program should be considered seriously, since the insurance carrier is in a position to see the over-all industrial and compensation picture, can analyze and interpret medical effort in similar industries, and can evaluate compensation losses in the light of existing compensation bureau practices.

Industrial Medical Ethics

THE PROBLEM OF medical ethics in industrial medicine has been widely discussed. Industrial physicians have varied in the strictness of their adherence to the rule that medical data is confidential and cannot be disclosed without the patient's permission, since such disclosure leaves the physician open to malpractice suit. Legal advice on this point varies in its interpretation of how far "professional secrecy" applies to industrial medicine. Aside from the question of legality, it is in the interest of good patient-physician relationship in industry to maintain, to some degree, the confidential nature of the employee's medical record. The compensation carrier must necessarily have access to the medical record. Supervisors should not, however, demand detailed knowledge of an employee's condition. The physician will want to explain fully his medical decision concerning an employee to the man's supervisor but he should not, since the details of the patient's ailment should be considered confidential information. However, an indication of the physical status of the employee, such as a weight limitation or other physical capacities appraisal, must be freely given where needed.

In discussions where the employee has invoked the aid of the union, the physician feels freer to disclose more detailed medical data. However, here, too, it is advisable to obtain the express permission of the patient before making such disclosures. The physician may say to the patient: "You understand that to reach a conclusion between management, the union, and yourself, I must apprise them of your condition—since they cannot reach an equitable decision without all of the facts. If you wish me not to discuss your condition here, then they cannot reach a conclusion themselves and must accept my decision in the matter." The employee will then almost invariably free the physician from the obligation to maintain professional secrecy.

A particularly difficult problem in industrial medical ethics arises, for example, when a case of syphilis is found in a cafeteria worker. This requires especially tactful handling, and it must be taken up directly with the patient alone. When such a case is disputed by the employee, or union aid is sought by the worker, the backing of the Board of Health is of inestimable value, since it is an impersonal, authoritative department of the state.

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Public Relations

THE PUBLIC relations aspects of industrial medicine depend, in part, on the relationships existing among the industrial physician, the general practitioners, and state health agencies in the area. Unfortunately, some degree of animosity had frequently been felt by the general practitioner toward the industrial physician. He felt that the company doctor was taking cases away from him, or was offering medical advice and treatment that he, as family physician, should be giving. This arose partly from lack of mutual understanding and partly from the industrial physician's practice of treating "non-company" conditions. However, this resentment is subsiding now because very few industrial physicians are continuing to treat non-company conditions, but refer these cases to the family doctor. It is further subsiding because the general practitioner is awakening to the fact that industrial medicine represents an enormous case-finding program for him. Many cases that he would not see, or would see too late to effect a cure, are being referred to him now from company health establishments.

Public relations are well served by a good medical program since the reputation of the industry among the population in the area becomes, "They take good care of you in that plant."

Selecting the Industrial Physician

OBVIOUSLY the hub of the medical program, whether it be simple or elaborate, is the industrial physician.

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It is unfortunate that medical schools still do not include the fundamentals of industrial medicine in their curricula and that very few post-graduate courses in this field are offered. For this reason, well-trained industrial physicians still must learn through apprenticeships, or must grow up in the industrial medicine field by trial and error. However, a few good post-graduate courses in this specialty are now being offered.

The most serious mistake one can make in initiating an industrial medical program is to select, as company physician, a young neighboring practitioner who has no interest in industrial medicine and wants the job only until his general practice develops to a point where it will support him. It is a mistake to chose a relative of a company executive who is interested only in the added income the job will provide, or to hire an elderly physician who has been unable to develop a satisfactory private practice and who may be well behind modern developments in industrial medicine and surgery. If he can be found, the physician to be selected is the man who has chosen industrial medicine as his specialty, who really has an interest in it, who can see that it is the field of medicine with most promise for pioneering good, and who intends to make it his life's work. Of all of the traits he should have, none is more important than tact and diplomacy. Obviously, he should be a graduate of an accredited school and have a well-rounded background of medicine. He need not be a specialist in surgery or orthopedics or internal medicine—in fact, he will perhaps serve the company best if he is not. He should be expected to have some training in industrial medicine. He should be in good standing in the medical fraternity. Aside from a hearty interest in the development in his specialty, he should have those traits that management seeks in a good organizer and director in any special field.

If the industry is large and is employing a full-time physician, management is in a position to choose carefully, since it can offer good facilities and the type of broad program that will attract the better physician. If the organization is small and in a community of small industries, the company's purposes will best be served through a clinic which pools the medical efforts of several small companies.

In conclusion, it should be remembered that the present trend toward broader compensation laws practically demands that management protect its own interests by setting up a medical program. Fundamentally, it is not difficult to do so. In addition to all its other merits, the industrial relations value of the program is incalculable. And, finally, since its success depends in great measure on the competence of its director, management's choice of physician is the key to the effectiveness of a modern industrial medical program.

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